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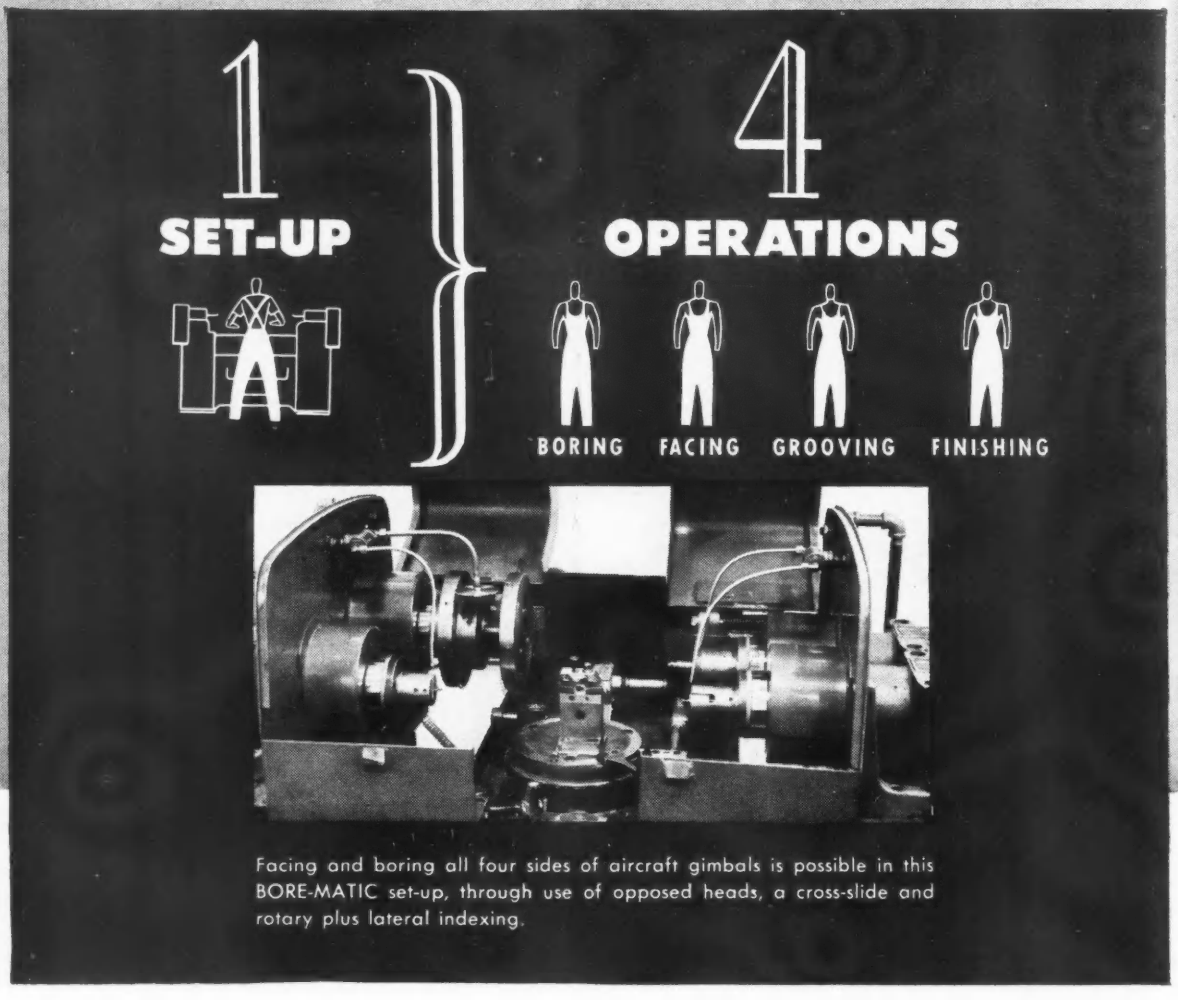

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The Beveridge Formula for Decay

by Julian Chase

SIR WILLIAM BEVERIDGE, the English advocate of a variety of so-called social security which extends that form of governmental beneficence from the cradle to the grave, before and beyond, has produced a book, or a report as he calls it, on another subject. The title of this latest Beveridge effusion is "Full Employment in a Free Society." But capable and comprehensive thinkers, it would seem, will conclude that the words "Free Society" are merely a part of the title. That is all. Why they were used is something that the author attempts but fails satisfactorily to explain.

What Sir William advocates in this book is a dictatorially controlled planned economy in a society that is slightly free and mostly slave—a large curd of sour milk in a small bottle of sweet cream. The natural and inevitable developments in both the society and the cream would be the same. To intelligent Americans, believers in the American enterprise system and in the potency of inspired individual initiative; to those with confidence in our Constitution and faith in its Bill of Rights who are seriously concerned over governmental trends during the past 12 years, the book will clearly but by no means concisely prove that a planned economy and a free society simply cannot exist together.

It would be difficult to find another book in which the author so convincingly proves the direct opposite of the premise implied in his title. As it cannot be fairly concluded that the title is deliberately misleading, one is prompted to inquire whether Sir William has the vaguest conception of what a free society is and is besides sublimely oblivious to the inmutable law of creeping growth in dictatorial control. Whatever the answer may be, we have, in his own words, strong arguments against the planned economy which he advocates. Americans who know what made America great will be surer than ever that they want no part of such an economy as he describes.

The Beveridge plan for full employment, in a society which inevitably would be progressively and rapidly less free, sets up three main requirements. It calls for what the author designates as "adequate total outlay," for controlled location of industry, and for organized mobility of labor. In other words, private expenditures for consumption and investment, governmentally regulated, plus public expenditures must balance employment (we have a similar proposal here now in the Murray Bill); industrialists must locate their plants where directed to do so by government; workers, under threat of penalty, must be ready to work at whatever jobs, in whatever plants and in whatever cities, towns or rural sections the government decides upon. Is that a free society?

With regard to private ownership of property used for production, Sir William says, "But if . . . it should be shown by experience *or by argument* that abolition of private property in the means of production was necessary to full employ-

(*Turn to page* 88, *please*)

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Super-State Cartels—

Their Control over the Domestic Economy and How America can combat them

By J. Howard Pew
President, Sun Oil Co.

A SUPER-STATE cartel is an arrangement requiring independent enterprises to restrict production, fix prices and/or allocate markets, made pursuant to an international agreement or treaty between two or more governments which undertake in some manner to enforce upon their nationals the terms and conditions of such an arrangement. It is a relatively new evolution of the cartel idea under the deceptive labelling of "trade accords." These agreements compound all the evils found in private and government-controlled cartels, adding to them a dangerous expansion of power in our Federal government through the treaty-making device. Illustrative of the super-state cartel is the abortive Anglo-American Petroleum Agreement submitted to the United States Senate last summer, but subsequently withdrawn under pressure of the unanimous protest of the American petroleum industry. The objectives of this proposal were never clearly set forth beyond vague statements that the purpose was to bring about an orderly development of the world's oil resources through the stabilization of the operations of the industry.

Such euphemisms as "orderly development"; "stabilization"; "fair competition"; "rationalized competition"; "elimination of waste" and "fair prices" always are used to describe the objectives of a cartel! They are terms which should immediately arouse your suspicions and command close scrutiny.

The Anglo-American Oil Agreement provided the framework for restrictions on the production of petroleum and its products, the fixing of prices and the allocation of marketing quotas upon the recommendations of an International Petroleum Commission. Inherent in the implications of the Agreement was the assumption of an obligation by our Federal government, when it concurred in such recommendations, to undertake to carry them out in the domestic field. This would necessitate the exercise by the Federal government of an authority which it does not now possess under our Constitution, since jurisdiction over natural resources is among the powers reserved to the States in the Tenth Amendment.

In dealing with super-state cartels in this article, the author necessarily includes private and government-controlled cartels in his discussion as all three types have much in common. The private cartel, to which he refers, is an arrangement whereby two or more ***independent*** *enterprises undertake to restrict the production, fix the prices, and/or allocate markets or sales quotas covering commodities in which they trade. A government-controlled cartel is such an arrangement under the direction or with the sanction of the government having jurisdiction over such enterprises and it usually contains provisions for the enforcement of the arrangement.—Editor.*

The Federal government would have obtained the authority to fulfill its part of the bargain made with other nations through the treaty-making power. Our Constitution makes treaties the supreme law of the land, on a par with the Constitution itself, and overriding other Federal laws, and State Constitutions and laws which may be in conflict with the treaty. Thus the reserve powers of the States would, through treaties dealing with them, fall into the orbit of Federal authority and jurisdiction. As a matter of fact, such a procedure is the only lawful way to cartelize American industry effectively since the NRA, a Government-controlled cartel, was declared unconstitutional.

Throughout the controversy over the Oil Agreement, it was difficult to avoid the conclusion that those who had proposed it were desirous of taking a short cut designed to change our American system overnight to the status of the German system of National Socialism. Just remember that the advocates of Socialism long have proposed the promotion of cartels in the conviction that a system of extensive monopolies controlled by the State paved the way for a Socialist economy. The Fascist and Nazis seized upon existing cartel systems for the foundation of their totalitarian states. For those reasons the super-state cartel is far more reprehensible and detrimental to the public welfare than private cartels entered into by individual companies, bad as they are.

This use of the treaty-making power to override Constitutional limitations and set the stage for transforming our American system into National Socialism is a danger that may engulf all of us. During the controversy over the Petroleum Agreement, it was reported that similar international agreements were contemplated covering approximately 60 commodities and services in international trade. These were said to cover rubber, tin, sugar, coffee, shipping cargo space and global airways. Undoubtedly others had to do with metals, leather, wool, cotton, chemicals, as well as manufactured articles that could be fitted into a cartel framework.

The list is sufficiently broad, if those plans are pursued, to encompass a large part of world trade in a super-state cartel system. More alarming, however, this movement would entangle a large part of our domestic economy in the tenacles of the vicious cartel system, with destructive repercussions upon every other line of economic activity. International trade and domestic trade are not two different things. They cannot be isolated in compartments, one from the other. They are parts of the same thing. This country cannot be cartelized in its foreign trade and free in its domestic enterprise, any more than a nation can survive "half free and half slave." Once we start to regiment through allocations, price fixing and production controls over activities in the foreign field, we, of necessity, will have forced upon us by the Government, restrictive measures upon operations falling wholly within the domestic field.

Turning to the arguments advanced in behalf of the negotiations of these super-state cartels, we find the contention that cartels are a necessary device to safeguard industry and invested capital against unfair and destructive competition and the wastes which result from wide fluctuations in industrial activity—that they serve to permit the orderly development of industries and stabilize prices.

Now all of that argument begs the question of what is best for the general welfare. The answer is obvious, since the primary purpose of cartels is to restrict competition. Competition, bringing better products at lower prices, benefits the consuming public. So whatever restricts competition in the long run harms the public welfare. Price stabilization usually means the establishment of a rigidity designed to protect high cost and marginal producers. It destroys incentives for low cost policies. Thus, cartels operate against the smaller or relatively newer enterprises which, through increased efficiency, are challenging the position of larger and older enterprises when the latter have become water-logged through plant obsolescence and inefficiency.

Another group asserts that although in normal times cartels may be undesirable, they are necessary devices for short terms in periods of depression to prevent the too precipitous drop in price levels, which have disastrous consequences. Perhaps here and there a showing of facts could be made to sustain that conclusion. But it also could be demonstrated that the operation of cartels creates depressions and prolongs them. The danger in resorting to cartels during emergencies is that the cartel survives after the real emergency has passed.

Aside from all of that, however, it is significant this argument is put forth at this time by the cartel advocates. This country does not face a postwar depression. This approach to postwar problems is illustrative of the defeatist attitude marking the economic thinking in Washington during the last 12 years. Too much Washington planning is being done under the shadows of the past. These planners should approach the problem in a venturesome spirit determined to seize upon the great opportunity presented for a dynamic expanding economy, the only hope for the restoration of full employment in this country.

Some argue that American participation in super-state cartels is necessary to assure lasting peace. But it was cartels, subsidies, unduly high tariffs, bartering and governments trading with other governments, which generated so much of the economic friction preceding this war. The cartel idea had its origin in Germany. When Adolf Hitler seized power he found in the cartel system a completely forged weapon for his program of rearmament and war.

This peace argument is based upon a corollary contention that they are necessary to expand world trade. Actually cartels operate to contract world trade. At best, they might serve to transfer markets from one nation to another without increasing the total of world trade. But if the ills of the world are to be healed through international trade, then the volume of international trade must be expanded. New consumer markets must be created and this can be done only through the production of better goods for sale at lower prices.

A healthy foreign trade is essential to our well-being as well as that of the rest of the world. Our Govern-

(*Turn to page* 98, *please*)

Labor Turnover

No. 1 Problem

at Aircraft Plants

By Donald W. Douglas

President, Douglas Aircraft Co.,
Chairman, Board of Governors,
Aeronautical Chamber of Commerce of America

THOSE who know the problems of management will appreciate the magnitude of the task in jumping production of so complicated a weapon as the airplane from 2141 in 1939 to 96,369 in 1944. The 1944 figure, incidentally, was made up of airplanes the average size of which was almost double that of the 1939 airplanes. The job was immense. It called for gearing-up of the industry, almost overnight to as much as a 1400 per cent increase in floor space and a 2800 per cent increase in employes in some of its major units. No one before had even considered seriously the problem of building precision instruments as large as airplanes by mass production methods. Engineering, tooling and factory organization necessary to quantity production on articles costing as much as $300,000 or $400,000 per unit were unknown. There are as many as 20,000 parts, excluding rivets, bolts and nuts, in an airplane and some airplanes required, in the beginning, as many as 340,000 man-hours on a giant 4-engine model, later reduced to 50,000.

Aircraft industry leaders foresaw the tremendous job of training new workers. In 1939, there were only 48,000 employes in all of our aircraft plants. In 1943, just four years later, we reached a peak of over 2,000,000, including the subcontractors.

We did not, and could not, foresee the selective service draft and its effect upon our small nucleus of trained personnel and, later, on our newly-trained employes. Between January 1, 1941, and December 1, 1944, the prime contractors in our industry released 340,000 trained workers to the selective service. One hundred thousand of these came from the West Coast airplane plants.

We did not, and could not, accurately foresee a labor market which would require an average of five employment interviews to find one potential aircraftsman, or a labor turnover of 85 per cent per year. With two employes quitting for each three hired, it was necessary in one company alone to employ 333,628 men and women to hold a working force of 157,200 employes on the payroll at one time. This, in turn, necessitated more than a million and a half interviews.

In the Douglas Company, with plants in Santa Monica, Long Beach and El Segundo, Calif., Oklahoma City and Tulsa, Okla.; and Chicago, a total of more than a quarter million employes had to be provided with various courses of instruction. Almost 75,000 men and women received training while being paid full-time wages. During a two and a half year period we found it necessary to transfer 165,000 employes to different jobs in a plant where only 40,000 were employed. To meet demands of increased personnel and changes in models and methods, and to supply supervision to the new plants, we had to give supervisory training to 21,000 men.

The companies comprising the Aircraft War Production Council, West Coast, namely, Boeing, Consolidated-Vultee, Douglas, Lockheed, North American, Northrop and Ryan, hired 142,190 new employes in 1944, but finished the year with a net loss of 76,000 workers. These companies in the two-year period ending 1944 arranged, supervised and completed 770,000 full-training courses for their employes.

As you can see, personnel was, and remains, our basic problem. Current demands by selective service for reclassification of all men under 30 again brings us face-to-face with a major crisis. By this time most of the physically fit men in this age group remaining in our aircraft plants have been deferred several times on the basis of their skill and need in the industry. This means that they are experts, specialists, men whom we cannot replace. It means that their loss, without opportunity of finding and training replacements, inevitably must lead to loss of production; how much, no one can tell with certainty.

In the gigantic task of helping build superior air power, the aircraft industry faced, and solved, many other difficult problems. We had problems of engineering for quantity production, of ordering materials, of storage, or transportation from mines, mills and laboratories, of scores of thousands of subcontractors and vendors, each with his own varied and acute problems and bottlenecks.

We wrestled with priorities, allocations, Government reports and endless regulations. We had to design and build new plants, new tooling, highways and special railroad cars. Inside our plants, we had to develop new

(*Turn to page* 109, *please*)

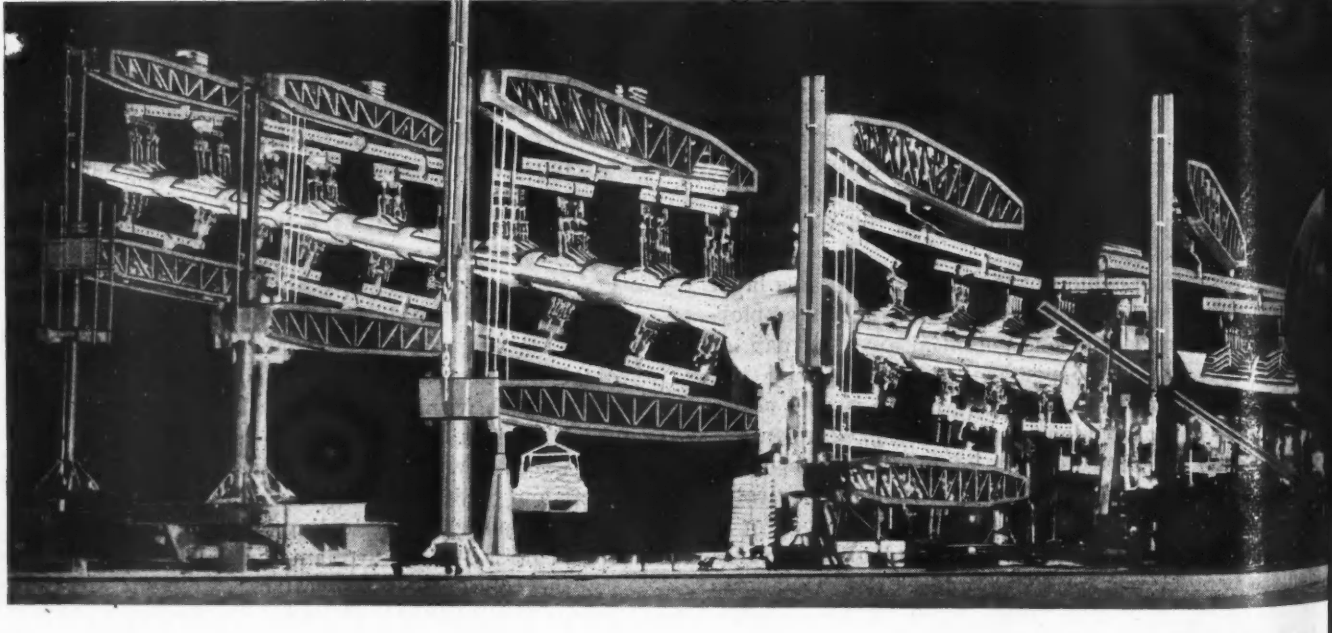
Adhesive Patch Method of

By E. H. Schwartz*
Lt. Colonel, Air Corps

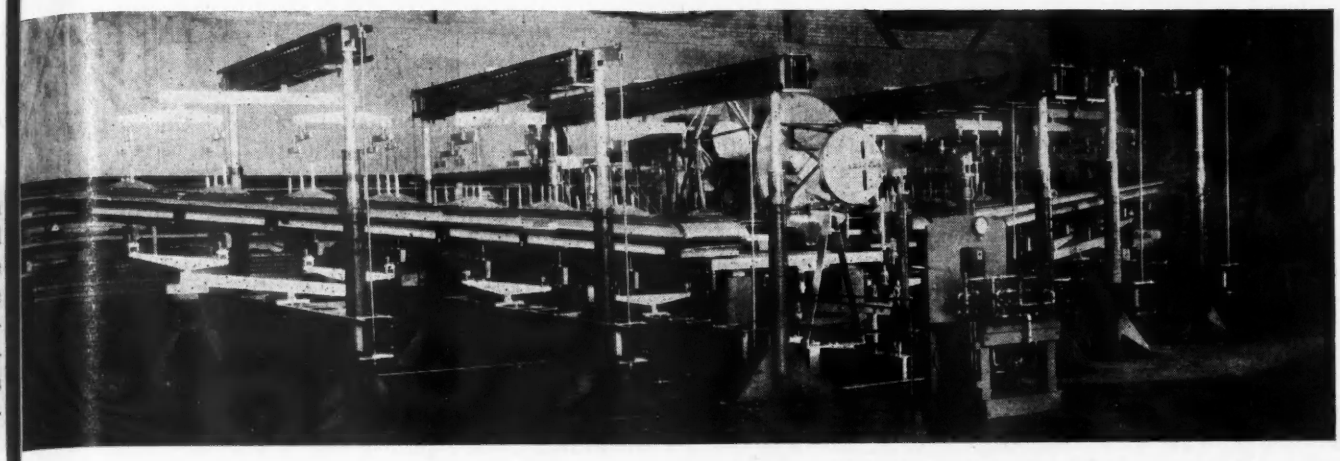
THE Adhesive Patch Method, commonly referred to as the Tension Patch Method, was conceived and developed by the Air Technical Service Command at Wright Field as an improved method for the static testing of aircraft structures. Briefly, this method, as used by the ATSC, consists of (a) Patches (tension or compression), made up of sponge rubber pads and base plates cemented together and to the surface of the test structure, (b) Leverage system, connecting the patches to hydraulic struts or jacks for applying tension or compression loads, and (c) Loading system, composed of hydraulic struts or jacks and operated by hydraulic pressure through control valves.

Wing under limit load, clearly showing compression wrinkles unaffected by tension patches.

In setting up a structure for test, patch areas are laid out and marked on the external surfaces according to the desired location and number of patches. The number of patches is determined from the load to be applied, desired unit working load of the patches, and the design of the leverage system to make use of available equipment. Sponge rubber pads, approximately one inch in thickness, and base plates are then cut to the size of these areas. The base plates, made of a plastic or metallic material, are molded or formed to fit the single or double curvature of the area, allowing for the

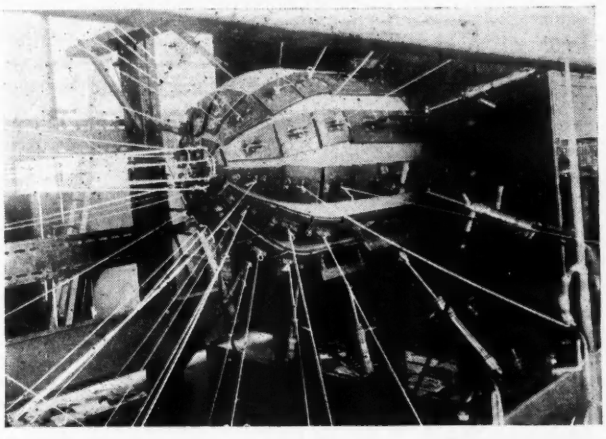


* Chief, Structures Branch of Aircraft Laboratory, Engineering Division, Air Technical Service Command, AAF, Wright Field. The opinions expressed in this article are those of the author and are not necessarily those of the Army Air Forces.



(Above) Adhesive patch test set-up on a training type airplane showing tension and compression patches loaded by low pressure hydraulic jacks.

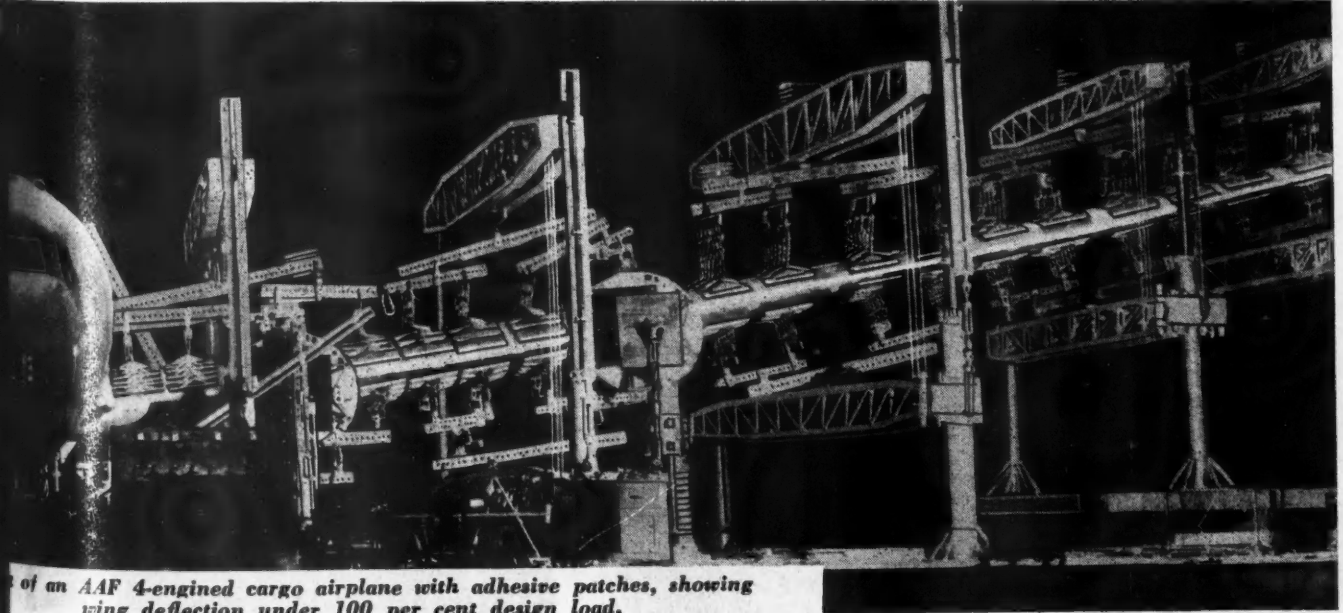
(Below) Tension patch set-up for testing a plastic radome.



thickness of the pad, to assure perfect fit of the patch to the structure. The base plates are generally made of 3/16 inch aluminum alloy or ⅛ inch steel sheet. In fabricating the tension and compression patches it is most important to locate the lugs on the plates so that the line of the load extends through the centroid of the area at the surface of the structure. One or two sets of lugs, riveted or welded to the plates, are usually employed for applying the load from the leverage system.

On metal structures the surfaces of the structure and base plates are thoroughly cleaned just prior to cementing. For cleaning, care must be employed to avoid use of any paint remover containing wax. The cement is applied by brush in two thin coats to each area of the structure and to one surface of the pads and is allowed to dry from 8 to 36 hours between coats,

Testing Aircraft Structures



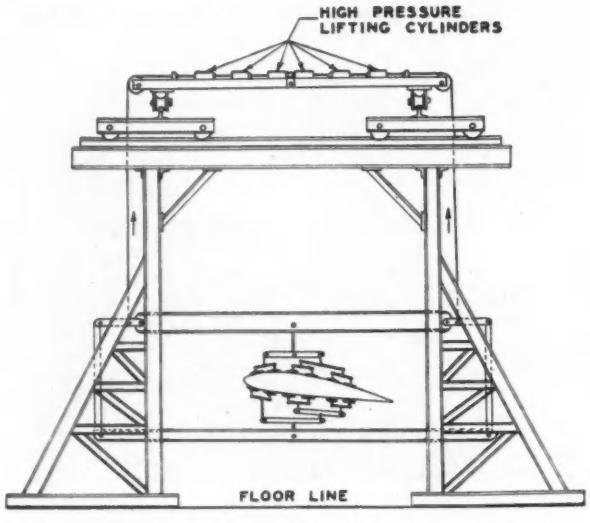
of an AAF 4-engined cargo airplane with adhesive patches, showing wing deflection under 100 per cent design load.

depending on the temperature and humidity of the air. The dry coats of cement are reactivated by sponging the surfaces lightly with toluol, toluene, or toluene substitute. The pads are then firmly pressed on the structure, taking care to exclude all air. Each patch is then weighed down for approximately 8 hours with about 50 to 75 pounds of sand or shot bags. The same procedure is followed for cementing the base plates to the pad to complete the adhesion of the patch to the structure. After 36 hours the patches are ready for use. The pads are often cemented first to the plates, then to the structure. Usually the cementing operations are accomplished during the assembly operations of the leverage system to save overall time. The same procedure is used for cementing pads to plastic structures. On plywood structures the procedure is similar except in some cases it has been found necessary to treat the plywood surface first with a thin coat of resin glue to fill the grain.

During the experimental stages of the development of the adhesive patch many types of sponge rubber and cement compounds were tested. At the present time Neoprene sponge of high tensile strength is used and has proved to be a very satisfactory substitute for natural rubber. Excellent results are being obtained with a Neoprene-metal cement of the cold setting type. On metal surfaces tension loads as high as 4400 lbs per sq ft have been developed with the above synthetic materials. On several tests of plywood structures tensile loads of 1300 lb per sq ft have been obtained. The working load on plywood depends on the thickness and support of the plywood covering due to the brash nature of wood.

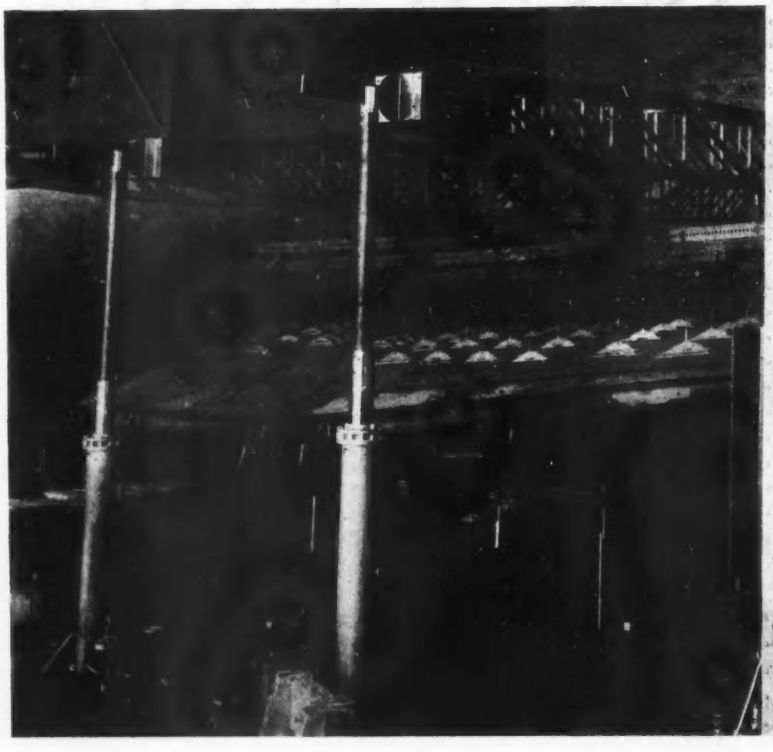
The leverage system is similar to that used by other methods of hydraulic testing. The system consists of a number of pantographic beams and "whiffle trees" made up of beams, links, equalizing bars, cables, etc., for connecting the patches to the hydraulic struts or jacks and is so designed as to give the proper distribution and center of pressure of the load.

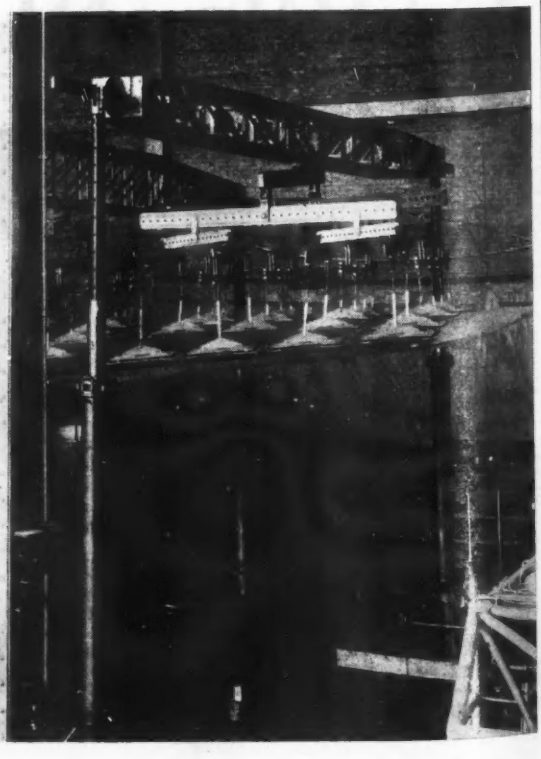
The loading system generally used by the ATSC consists of hydraulic struts or jacks, pumps, control valves, piping, etc. In the past low pressure hydraulic jacks, operating up to 250 lb per sq in. with strokes of 48 in. and 132 in. were used. These jacks were of the floor type and were designed to operate in either direction. Experience with these jacks showed this type to be inferior to high pressure struts due to (a) high friction, (b) limited stroke, and (c) binding of the piston due to bending as a column under normal compression loads on the jacks. For these reasons the low pressure system has been discarded for the high pressure system. Precision-built re-

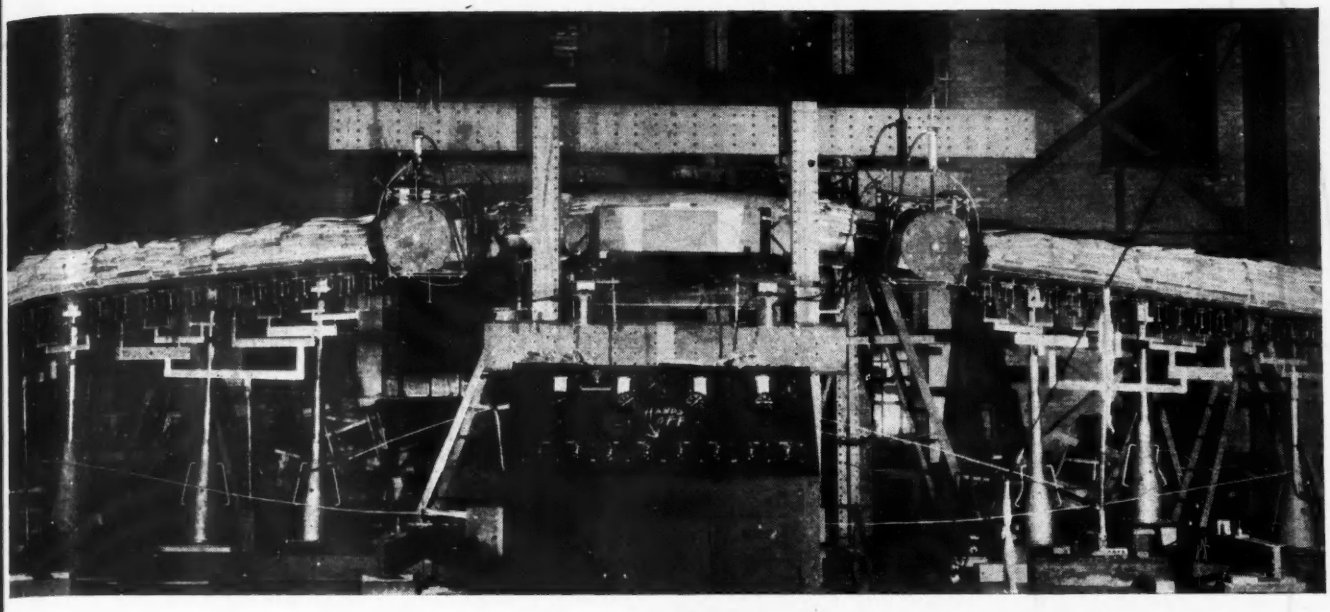


(Above) Tension patch set-up to be used for testing the wing of a large bombardment airplane.

(Below) Testing the wing of a twin-engined cargo airplane with tension patches.







(Above) Positive high angle of attack condition special set-up (tension patches—dead load) for investigation of the weakness of the plywood leading edge of a twin-engined AAF airplane.

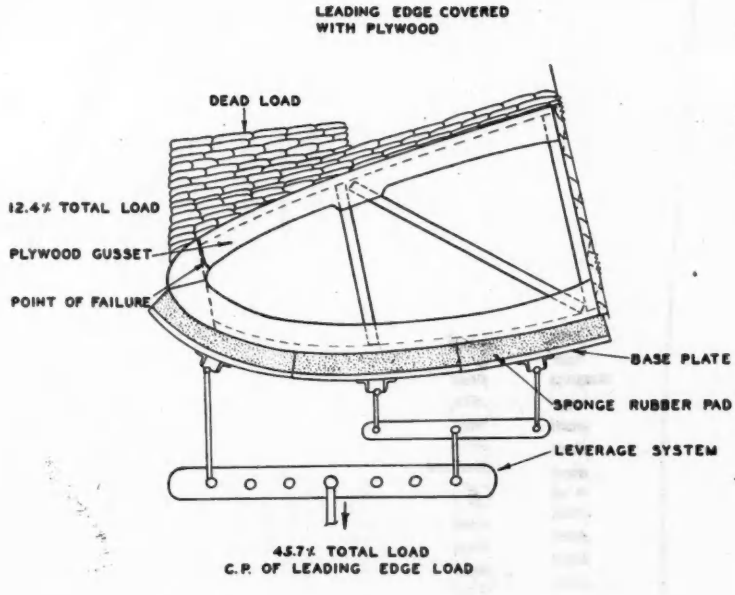
(Below) Special tension patch set-up used to investigate weakness of the plywood leading edge of an AAF airplane.

traction struts from aircraft are used for the high pressure system up to pressures of 2000 lb per sq in. The high pressure struts are used in tension and can be added in multiples as necessary to attain the desired travel. The struts can be mounted in any position by the use of pulleys and cables. For small loads, dead weight is sometimes used in place of hydraulic struts for loading.

Recent improvements in the Adhesive Patch Method, which will be used in the near future in the structural tests of the wing of a large bombardment airplane, consist of an assembled overhead structure on which are mounted pairs of cars (see drawing). The bottom car is free to move chordwise on the overhead structure while the top car is free to move spanwise on the bottom car. Thus vertical alignment of the leverage system will be automatically maintained with drift and deflection of the structure. In this set-up the struts are laid horizontal. Both tension and compression patches will be used to maintain proper pressure distribution between upper and lower surfaces of the wing.

This improved method is universal in nature inasmuch as it permits the testing of any size aircraft at any location without requiring turning of the airplane over on its back. This is particularly desirable for testing of large aircraft and for proof testing of flight articles.

The Adhesive Patch Method is used principally by the ATSC for testing wing structures of large aircraft, canopies, windshield, radomes, doors, engine cowling, etc., where the proper distribution of loads is of primary importance. This method is the only accurate method of testing for negative air loads. Commonly used methods, such as dead load and rubber bags (air or hydraulic), load the wrong side by positive pressure and will not show up any weaknesses in glue joints in tension or delamination tendencies of wood or plastic materials.



By this method it is possible to test a complete airplane for one design condition with one set-up and with one fluid pressure and control valve by proper design of the system and use of proper size struts. Struts are utilized for taking out inertia loads of masses in the airplane and may be operated in the same hydraulic system. The principal advantages of the Adhesive Patch Method with the hydraulic system are:

a. Proper distribution of load between upper and lower wing surfaces.

b. Simulates negative and positive pressure loadings.

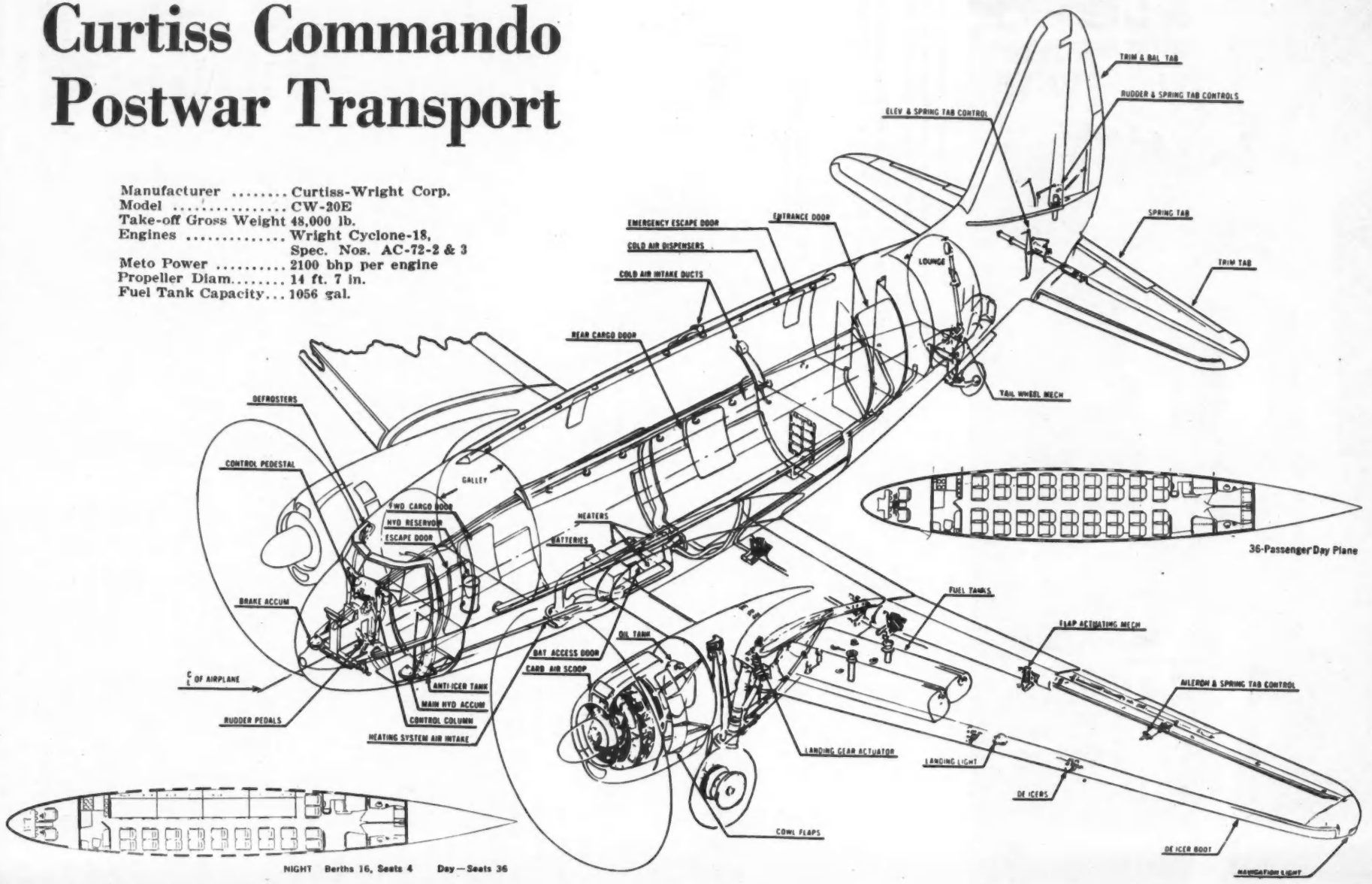
c. No effect on natural stress distribution or on natural formation of compression and shear wrinkles.

d. Permits, without danger, observation of struc-

(*Turn to page* 90, *please*)

Curtiss Commando Postwar Transport

Manufacturer ..... Curtiss-Wright Corp.
Model CW-20E
Take-off Gross Weight 48,000 lb.
Engines ..... Wright Cyclone-18, Spec. Nos. AC-72-2 & 3
Meto Power ..... 2100 bhp per engine
Propeller Diam..... 14 ft. 7 in.
Fuel Tank Capacity... 1056 gal.



Dimensions

Summary of Weights (Lb)

Surface Controls	394
Hydraulic System	732

Dimensions

1. Wing

Span	108 ft
Area	1358 sq ft
Aspect Ratio	8.58 to 1
Root Chord	198 in
Tip Chord (Extended)	70.81 in
Mean Aerodynamic Chord	164.25 in
Airfoil Sections	Root—NACA 23017 Tip—NACA 4410.5
Wing Flap Span Total (Projected)	50.92 ft
Wing Flap Area, Center Panel Each	46.92 sq ft
Wing Flap Area, Outer Panel Each	51.79 sq ft
Aileron Span Each (Projected)	23.12 ft
Aileron Area Total Each	42.84 sq ft

2. Empennage:

Elevator Area Total (Both)	91.50 sq ft
Stabilizer Area (Both)	181.48 sq ft
Rudder Area (Total)	52.80 sq ft
Fin Area	112.20 sq ft

3. Fuselage:

Overall Length	76.31 ft
Overall Height (On Ground)	21.7 ft
Diameter of Upper Lobe at Maximum Cross Section	126.0 in
Diameter of Lower Lobe at Maximum Cross Section	116.9 in

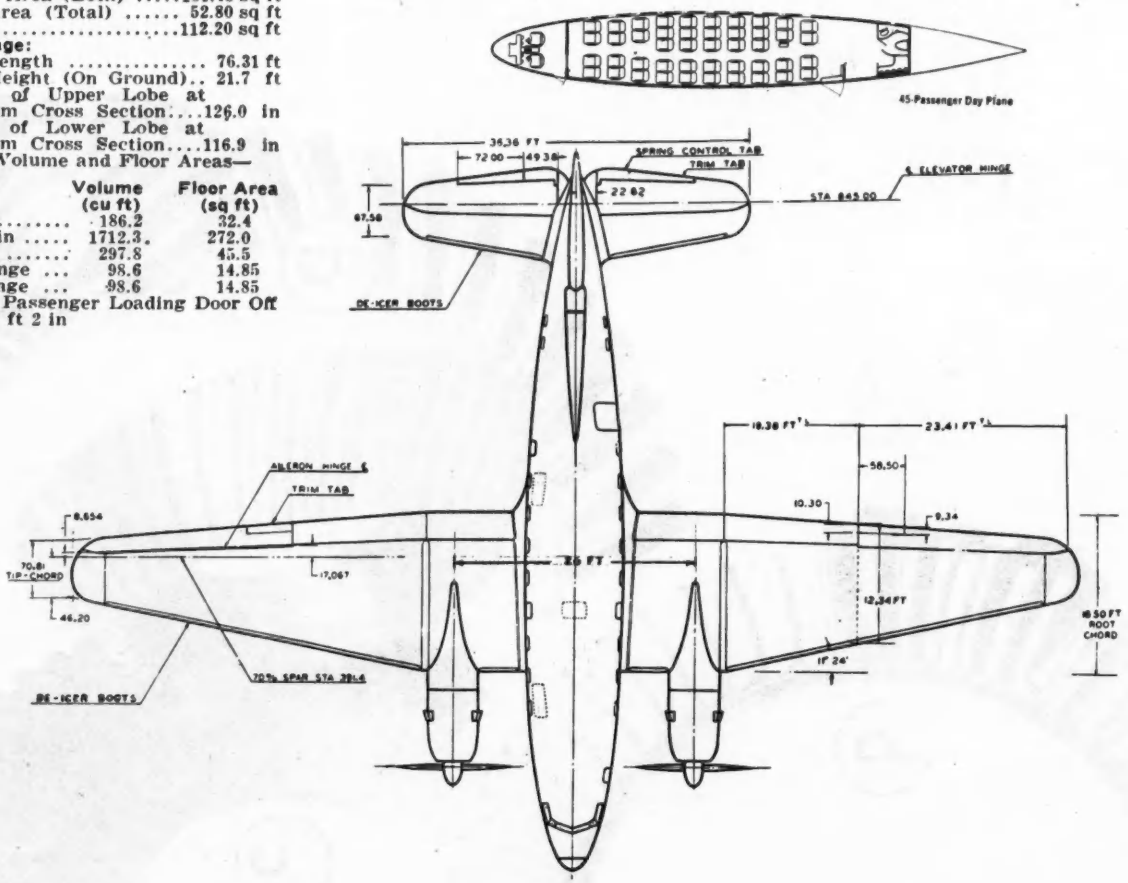
Fuselage Volume and Floor Areas—

Section	Volume (cu ft)	Floor Area (sq ft)
Galley	186.2	32.4
Main Cabin	1712.3	272.0
Vestibule	297.8	45.5
R.H. Lounge	98.6	14.85
L.H. Lounge	98.6	14.85

Height of Passenger Loading Door Off Ground—7 ft 2 in

Summary of Weights (Lb)

1.	Design Gross Weight	48,000
2.	Useful Load	15,900
3.	Total Weight Empty	32,100
3a.	Total Structure	16,919
	Wing Group	6,342
	Tail Group	1,093
	Body Group	4,429
	Main Landing Gear	2,776
	Auxiliary Landing Gear	469
	Nacelle Group	1,810
3b.	Total Power Plant	8,831
	Engines	5,914
	Engine Accessories	333
	Power Plant Controls	78
	Propeller Installation	1,157
	Starting System	85
	Lubricating System	480
	Fuel System	784
3c.	Total Fixed Equipment	6,350
	Instruments	126
	Surface Controls	394
	Hydraulic System	722
	Electrical System	1,022
	Communicating System (Optional)	380
	Furnishings—Personnel	2,384
	Furnishings — (Galley—Optional)	75
	Furnishings—Emergency	246
	Furnishings—Air Conditioning	379
	Furnishings—Prov. for Flight	192
	Anti-Icing Equipment	307
	Auxiliary Power Plant	0
	Service or Design Pickup	123
4.	Center of Gravity—%M.A.C. (Weight Empty—Wheels Up)	22.13
5.	Operational Weight (not including fuel)	1,770
	Two pilots	340
	Two stewardesses	260
	Passenger Service Equip	250
	Galley Supplies	500
	Oil (56 gal)	420



Payload

Trip Length (mile)	Payload (Lb)
200	11,100
400	10,400
600	9,450
800	8,500
1,000	7,600

Performance Data

1. High Speed with Normal Rated Power @ 48,000 lb:

	Low Blower	High Blower
Sea Level	265 mph	
5,500 ft	280 mph	
15,000 ft		286 mph

2. Cruising Speeds with 60% Meto Power—1260 bhp per Engine @ 48,000 lb:

	Low Blower
Sea Level	215 mph
5,000 ft	224 mph
10,000 ft	234 mph
15,900 ft	244 mph

3. Cruising Speed with Maximum Cruise Power 64.7% Meto—1360 bhp per Engine @ 48,000 lb:

	Low Blower
Sea Level	222 mph
5,000 ft	232 mph
10,000 ft	242 mph
14,000 ft	251 mph

4. Climbs:

Rate of Climb at Take-off Weight of 48,000 lb:

	Low Blower	High Blower
Sea Level, Take-off Power	1810 ft/min	
Sea Level, Meto Power	1490 ft/min	
5,500 ft Meto Power	1410 ft/min	
15,000 ft Meto Power	720 ft/min	970 ft/min

	Low Blower	High Blower
Time to Climb to 5,000 ft	3.5 min	
Time to Climb to 10,000 ft	7.4 min	
Time to Climb to 15,000 ft	13.2 min	12.4 min

5. Absolute Ceiling @ 48,000 lb—26,300 ft (Low Blower); 28,500 ft (High Blower).
6. Service Ceiling R/C 100 ft/min @ 48,000 lb—24,600 ft (Low Blower); 27,200 ft (High Blower).
7. Maximum Weight to Meet Climb Requirements of CAR Sections:
   - 04.7531 T (a) Landing Sea Level 46,700 lb
   - 04.7531 T (b) Landing Sea Level 46,400 lb
   - 04.7531 T (c) Take-off Sea Level 48,000 lb
8. Take-offs and Landings:

Take-off Distance over 50-ft Obstacle with Take-off hp at S.L.—2320 ft

Landing Distance over 50-ft Obstacle at Sea Level—2200 ft

Required Runway Length to meet Take-off Regulations of CAR 61.7122, assuming Take-off Weight of 48,000 lb—5100 ft at S.L.

Required Runway Length to meet Landing Regulations of CAR 61.7123, assuming Maximum Landing Weight of 46,400 lb—3700 ft at S.L.

Maximum One Engine Inoperative Operating Altitude to Meet Requirements of CAR 04.7513—T: for 47,200 lb—10,200 ft altitude 129 fpm R/C (Low Blower); for 47,200 lb—10,700 ft altitude 129 fpm R/C (High Blower).

The Design o

By L. J. O'Brien
Mechanical Engineer,
Gleason Works

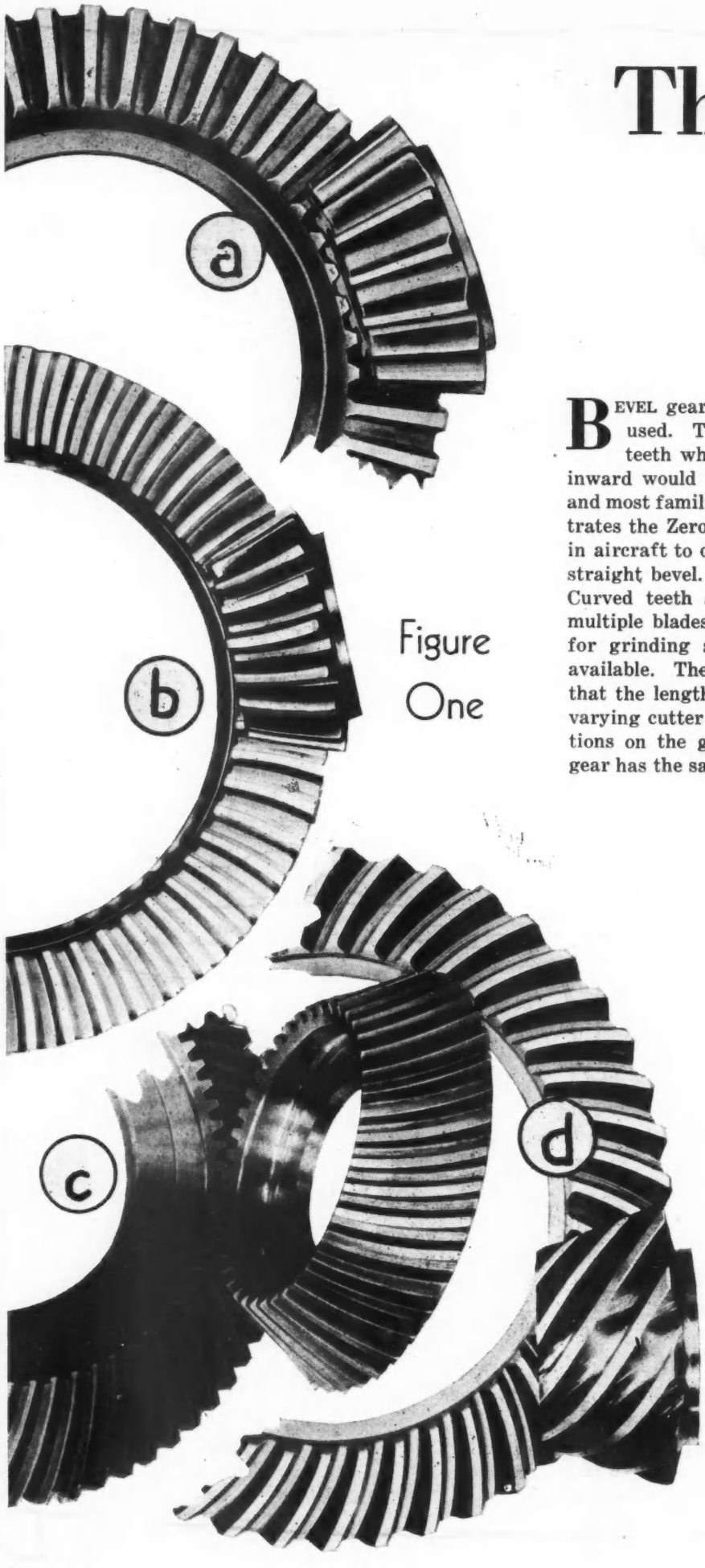


Figure One

BEVEL gears differ in respect to the type of teeth used. The straight bevel gear, Fig. 1 (a), has teeth which are straight and which if extended inward would intersect the axis. This is the oldest and most familiar form of bevel gear. Fig. 1 (b) illustrates the Zerol gear which has been extensively used in aircraft to overcome some of the limitations of the straight bevel. This type of gear has a curved tooth. Curved teeth are cut with face-mill cutters having multiple blades and can be ground, whereas machines for grinding straight teeth in bevel gears are not available. The curved tooth always has the advantage that the length of tooth bearing can be controlled by varying cutter radii so as to allow for different deflections on the gears under different loads. The Zerol gear has the same thrust and tooth action as a straight bevel and may be used in the same mountings. However, all front and rear hub projections above the root line must be eliminated, as illustrated in Fig. 2, to provide cutter clearance in curved tooth gears.

Spiral bevel gears, as shown in Fig. 1 (c), have curved, oblique teeth in which contact begins gradually and continues smoothly from end to end, and consequently are used for transmitting heavy loads at high speeds, especially where smoothness and quietness are required. Spiral bevels properly designed will have at least two teeth in contact at all times and for this reason will transmit as much as 30 per cent more power than the corresponding straight or Zerol bevels. The direction of

This article is based on Mr. O'Brien's paper, "Aircraft Bevel Gears," presented at the 1944 National Aeronautic Meeting of the Society of Automotive Engineers at Los Angeles, Calif.

Fig. 1
(a)—Straight Bevel Gear Set
(b)—Zerol Bevel Gear Set
(c)—Spiral Bevel Gear Set
(d)—Hypoid Gear Set

# of Aircraft Bevel Gears

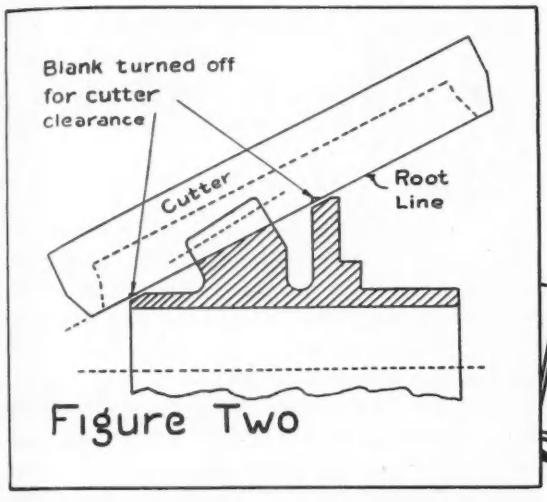


Fig. 2—Clearance required for curved tooth cutting

endwise thrust in spiral teeth may vary with the direction of rotation. This has led to a misconception that spiral bevels are good for one direction of rotation only. The only requirement of a spiral-bevel gear set for reversible operation is that the members be held equally well against thrust in both directions. No distinction is made between the efficiency of straight and spiral bevel gears. Accurately manufactured gears of this type, properly adjusted in the mountings, are customarily rated at 98 per cent efficiency.

The hypoid gear and pinion shown in Fig. 1 (d) are similar in general to spiral bevel gears except that the pinion axis is offset from the gear axis. The gear and pinion shafts of the hypoid pair may continue past each other to allow compact multiple drive arrangements.

(*Turn to page 74, please*)

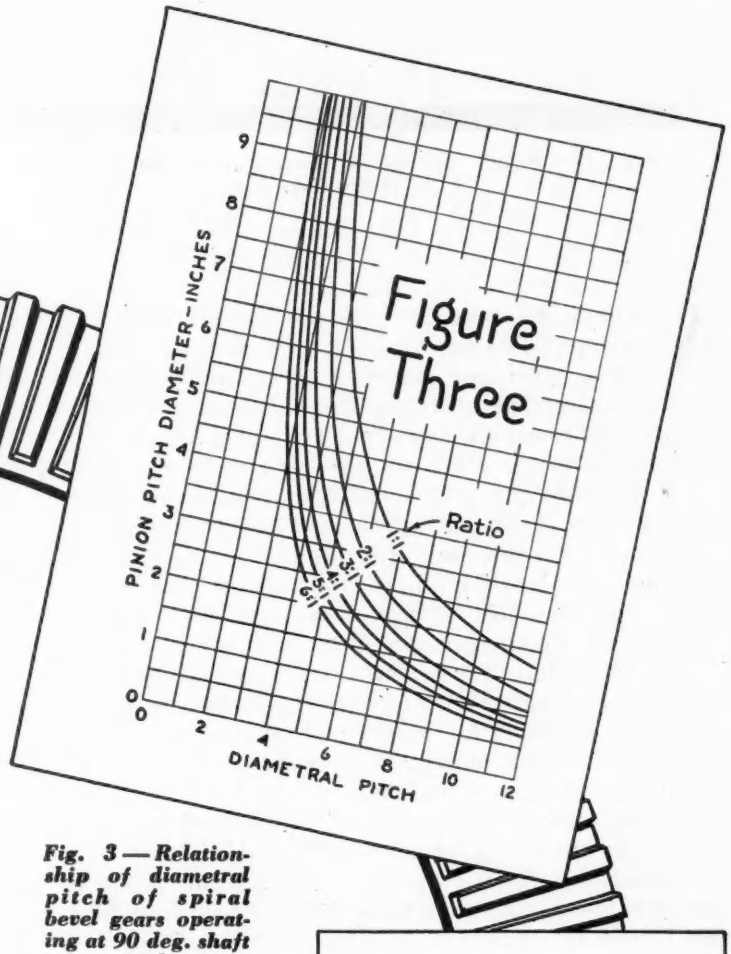
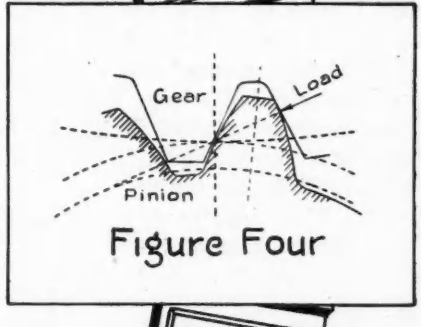


Fig. 3 — Relationship of diametral pitch of spiral bevel gears operating at 90 deg. shaft angle

Fig. 4—Position of worst condition of loading on one pinion tooth

Fig. 5—Position of worst condition of loading on one gear tooth



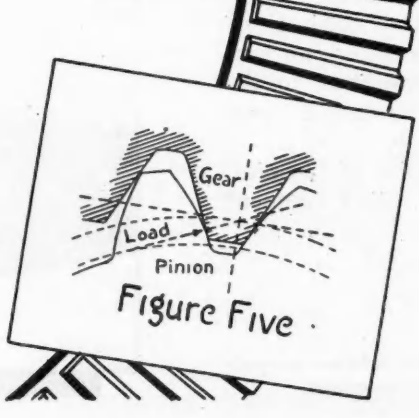


Table I—Maximum Design Loads (lb.) Based on Surface Durability of Ground Tooth Spiral Bevel Gears For Aircraft Applications

Teeth In Pinion	Diametral Pitch					
	3	4	5	6	8	10
12 — 14	2450	2120	1900	1730	1500	1340
15 — 18	2740	2370	2120	1935	1675	1500
19 — 23	3085	2670	2390	2180	1890	1690
24 & up	3465	3000	2685	2450	2120	1900

Note: Mountings and lubrication must be in accordance with best practice in order to transmit the above loads satisfactorily.

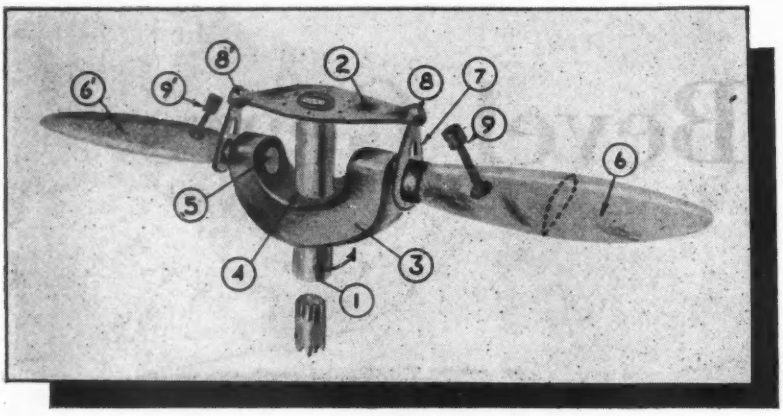


Fig. 1 — Details of the Wickwire automatic propeller mechanism

Self-Contained

By Dimitry E. Olshevsky
Consulting Engineer

As a result of far-reaching advances in controllable pitch propeller development, there exists at present a wide gap between governor-controlled, auxiliary power operated propellers for high powered engines and the conventional fixed pitch propellers used in smaller aircraft. This gap is of both constructional and functional significance: the highly complicated and efficient units of the first group and the simple, but limited one-piece ordinary propellers.

Somewhere between these two engineering extremes lies the field of usefulness and the future destiny of a simple, self-contained, automatically adjustable propeller. Possessing a large proportion of the governor-controlled propeller performance features at a decidedly lower cost and much lower unit weight—the simple automatic propeller certainly can justify its acceptance and most likely will enjoy a widespread use in those types of aircraft where its advantages are most pronounced. The added features of completely automatic operation requiring no attention or adjustments by the pilot, of lower maintenance and inspection costs and of lower number of spare parts will further contribute to its value.

While both manual and automatic pitch adjustment produces similar effects upon airplane performance, the advantages to be derived from a self-contained automatic pitch regulation in flight are quite basic. They involve:

1) Elimination of instrument panel control and indicator.

2) Elimination of power transfer and control connections to the rapidly rotating propeller hub.

3) Relief of the pilot from a rather frequent operation of an additional control.

4) Elimination of a separate source of power.

On the other hand, self-contained automatic pitch regulation in propellers has its inherent design difficulties arising from two main causes:

1) Limitations of simple, dependable regulation mechanisms with regard to taking care of all possible cases of pitch regulation in flight.

2) Large magnitude of frictional forces in the blade bearings, due to high centrifugal thrusts—coupled with limited amount of regulation power usually available without a separate motor.

Airplane performance improvements due to automatic propeller blade pitch adjustment in flight at various speed have their origin in better utilization of engine power and in an increase of propeller efficiency. Both are connected with pitch decrease at slower forward speeds and in take-off, enabling approximately constant RPM and consequently a practically constant power output by the engine. Simultaneously, blade element operating conditions close to their best efficiency angles of attack are made possible.

The amount of performance gain which can be realized in a particular airplane depends upon several factors. Chief among them are the design maximum speed of the plane and its speed range—the ratio of high speed to landing speed. Advantages to be de-

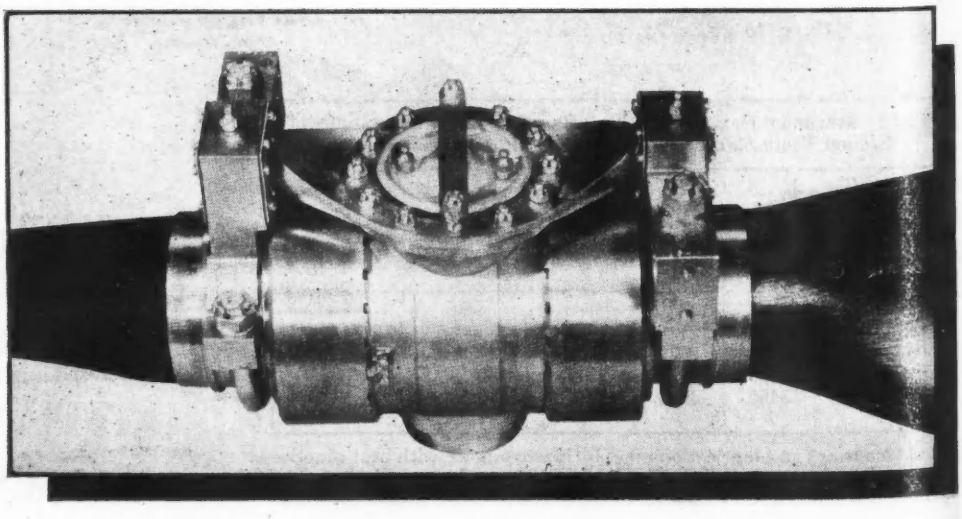


Fig. 2 — Wickwire propeller assembly

Automatic Mechanism of the

Wickwire Propeller

rived from automatic propeller pitch regulation increase with the increase of both of these quantities. They are quite substantial in modern planes.

Since the speed range is continually increasing as a result of airplane development while high speed is indirectly connected with the rating of the powerplant, automatic propellers have increased prospects of usefulness in modern planes of moderate power. High-powered, high speed transport and military planes will in all probability continue to use the auxiliary-powered, governor-controlled, adjustable-pitch propellers.

Compared with the fixed-pitch propeller, one basic advantage to be gained by the installation of an automatic propeller is the improvement in take-off performance, obtained by considerable thrust increase during acceleration. Both length of run and its time are decidedly decreased, enabling utilization of smaller airports as well as safer take-off from airports of higher elevation. In the low speed operating conditions, such as climbing and horizontal flight of a two-engined plane with one engine dead, the advantages are quite pronounced. In the flight stage immediately after take off, the usefulness of the extra thrust delivered by the automatic propeller is of importance as it enables the pilot to gain faster the increase of speed necessary for safety in meeting certain emergencies. Either high speed or cruising speed performance is improved over ranges differing from the design conditions of the fixed pitch propeller.

Development of controllable pitch propellers has been proceeding along two distinct lines of thought. One was to devise a mechanical system, without primary regard to cost or complication, capable of furnishing maximum propeller efficiency at practically all flight contingencies with occasional adjustment of the RPM control by the pilot. The other made its point of departure from an essentially simple, rugged mechanical conception and was satisfied to derive a large part of general adjustable pitch advantages at little sacrifice in cost and complication compared to a fixed pitch propeller. No attention whatsoever was expected from the pilot during flight.

(*Turn to page* 67, *please*)

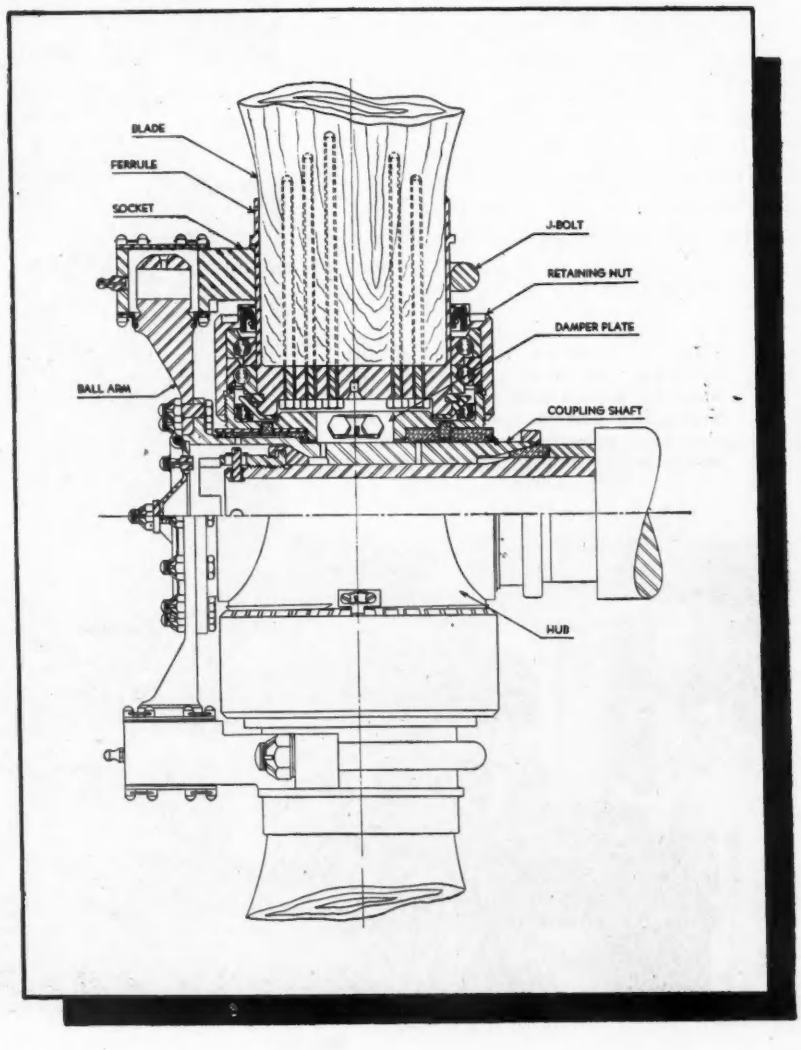


Fig. 3—Partial section view showing construction of Wickwire propeller mechanism

Distinctive Features of Sterling

Permanent Molds for A

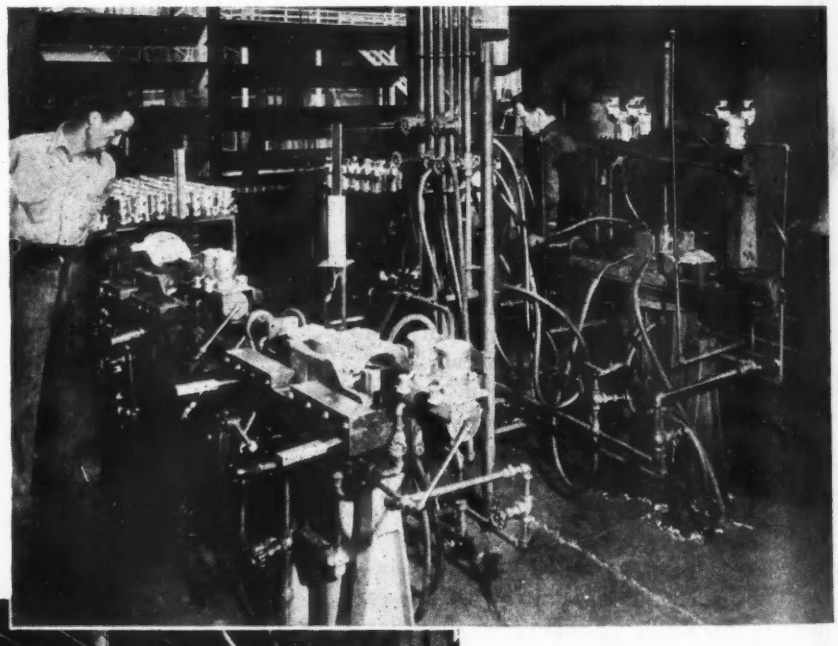
By

TWO MILLION pounds of aluminum alloy permanent mold piston castings are being produced monthly in one plant. Celebrating its 25th year of service to the automotive industry—early in 1944—as a piston specialist, the Sterling Aluminum Products, Inc., of St. Louis, believes that this record places the company at the top as a supplier of piston castings.

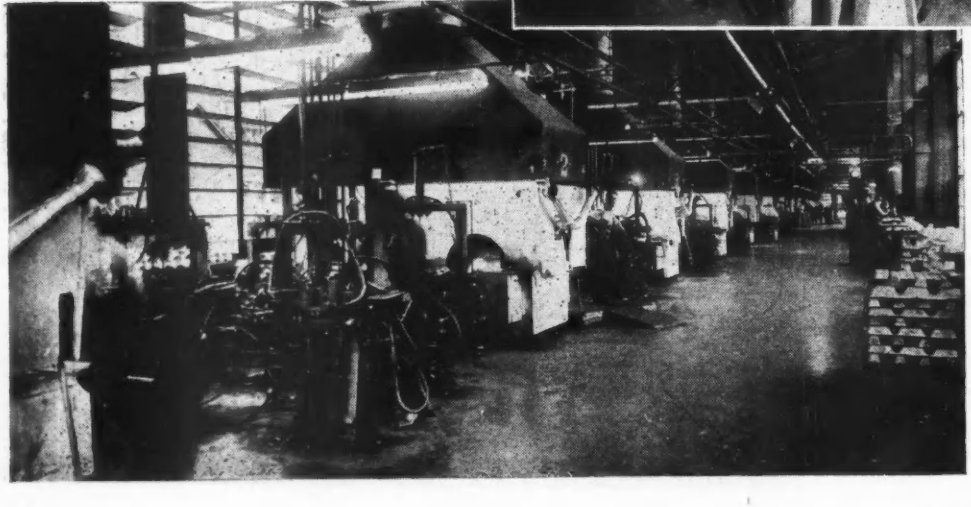
Specialization has developed advanced techniques not only in the design of pistons for specific engine applications, but in the design of permanent mold equipment and in foundry procedures. Patented permanent mold equipment, used by certain other manufacturers under licensing agreements, is said to produce pistons of unusual quality, featuring density of structure, freedom from porosity, fidelity of dimensional tolerances, and exceptionally fine finish of the cavity. In addition to the piston castings, which are supplied in enormous quantity to motor car manufacturers and engine builders, the company has facilities for machining pistons and operates an engine rebuilding plant considered to be the largest of its kind in this country.

During the past year Sterling placed in operation a new permanent mold aluminum foundry exemplifying the fruition of its long years of experience in this field. It possesses feature of great interest to our readers. Worker comfort and good housekeeping form the background for the design and arrangement of equipment. The long foundry bay is arranged along the south wall of the building, the wall being open save for an installation of heavy venetian blinds which can be opened or closed at will, depending upon the weather.

This bay has an installation of some 13 furnaces fitted with exhaust hoods for venting fumes and heat. Each of the furnaces feeds two banks of permanent mold machines, one bank of two machines on each side, each bank tended by one operator. To further aid worker comfort, for each new row of machines



(Right) Close-up of one of the molding stations, featuring the Sterling permanent equipment for producing pistons. At the left the operator may be seen pouring a mold with the special two-lipped ladle.

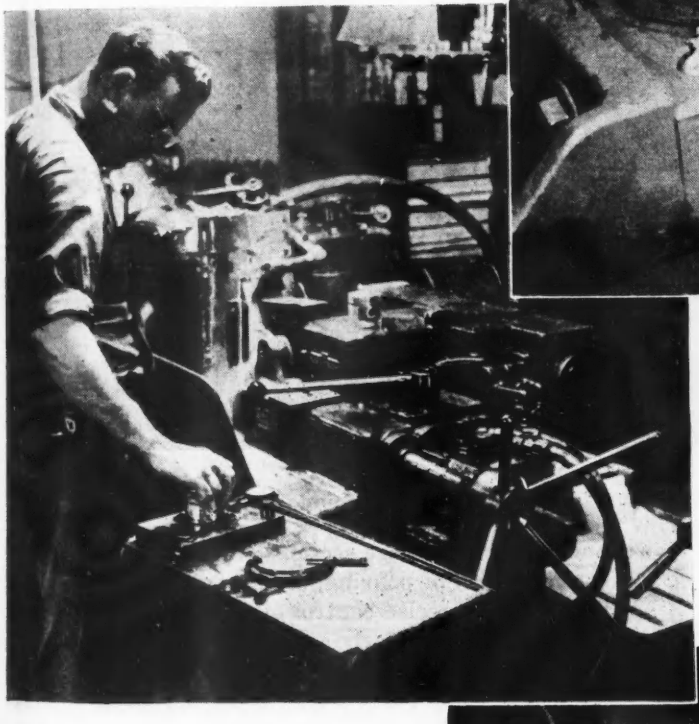


(Left) Looking down the main foundry bay in the new plant, handling about half of current foundry capacity. Each of the furnaces has a capacity of 2000 pounds of melted aluminum alloy, with automatic pyrometer control of temperature. The furnaces are fired with natural gas.

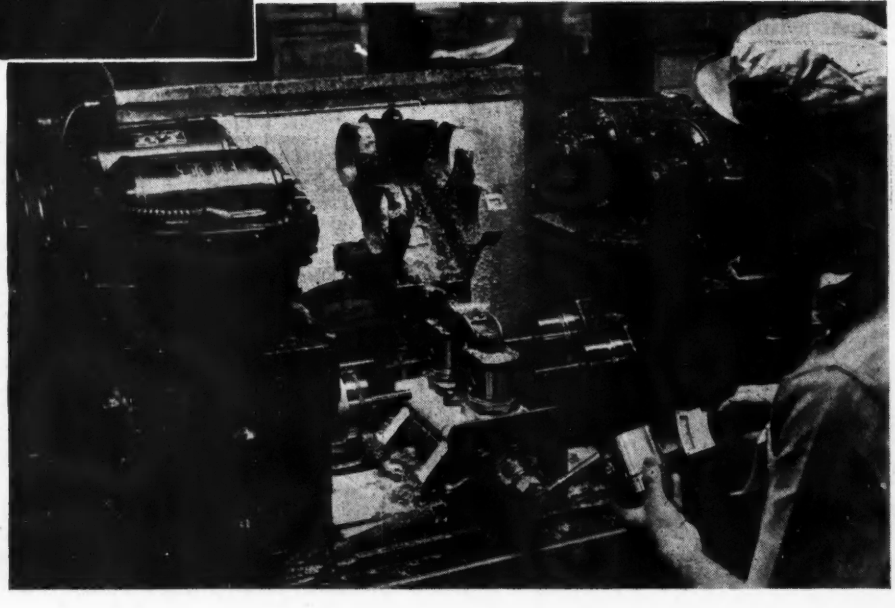
Aluminum Piston Castings

By *Joseph Geschelin*

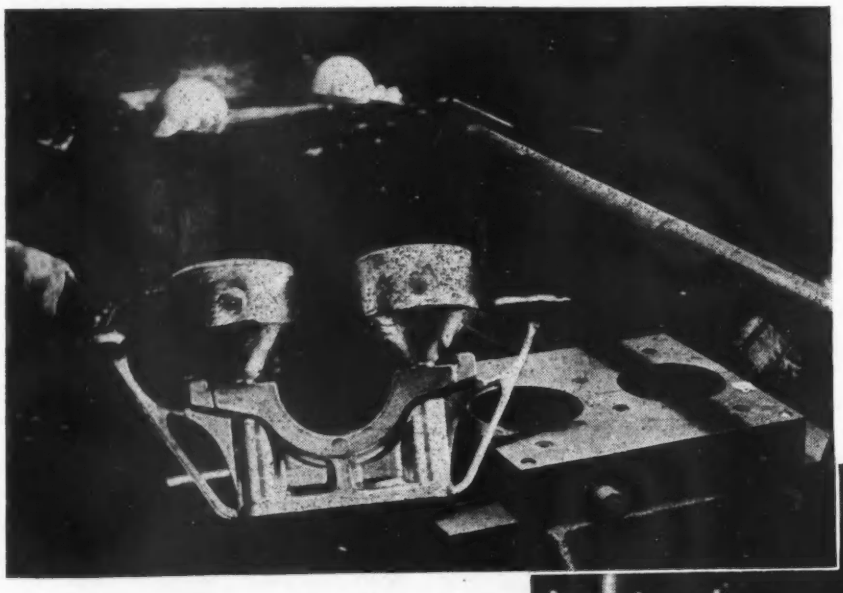
(Right) One of the precision-made permanent molds in completely open position. Each half of the outer mold and each half of the inner core is hydraulically operated and controlled independently.



(Below) In the piston machine shop—one of the Ex-Cell-O diamond boring machines set up for finish-boring piston pin bores, holding tolerance to plus or minus 0.00015 in.



(Above) This Cincinnati Centerless grinder equipment is said to have revolutionized piston finishing at Sterling. The machines shown here are fitted with newly developed attachments for camgrinding to extremely close tolerances at the rate of three pistons per minute per machine.



(Left) Indicative of postwar possibilities in this main bearing cap for an automotive type tank engine. Note particularly the gating procedure.

(Below) Real mass production is found in the manufacture of Lockhead hydraulic master brake pistons. These are made in four-cavity molds with gating as shown.

there is a blower fan mounted in the lower portion of the wall. Each furnace is carefully controlled for temperature range which is adjusted and maintained by automatic pyrometer control.

Sterling permanent mold design has a number of distinctive features contributing to the quality of the castings and to operating economy as well. For one thing, the outer mold and innner core sections, which are precision made, are both mounted permanently on the fixture. The sections are made in symmetrical halves and are opened and closed mechanically, one section at a time, in a timed cycle through push-button controls. Thus the mold is closed properly for pouring, then following a timed interval of cooling it is opened in sequence, first by moving the mold sections outward, then by collapsing the core sections inwardly, one at a time. The core is properly cooled by circulating water into the core sections through copper tubes. Positive control of pouring, cooling and opening of the mold provides precise control of the operation of each mold and is one underlying reason for perfection of quality.

At the present writing Sterling employs some 17 different aluminum alloys, including various types of high-silicon analyses, supplied by (*Turn to p.* 68, *please*)

Another bay in the new foundry showing the row of familiar Sundstrand Stub lathes used for rough machining of pistons. Lockheed brake pistons may be seen in the foreground.

Airbriefs

By Henry Lowe Brownback

That Surplus

There is already a cloud of no mean proportions forming on the horizon and the politicians will soon begin to pound their chests and expound words of wisdom on the subject of surplus war supplies. It is a many sided question and one which cannot be solved without hurting someone and hurting him badly!

For the past several years this country has snapped out of a depression which had bedevilled both the Hoover and Roosevelt Administrations and one which was far from being solved when war broke out in Europe. With ourselves the only producer of mechanical goods in quantity safe from bombing, we began to produce at a rate never before equalled and which will probably never again be equalled unless we find some way of reworking material or new sources of natural resources to supplement those which are, in many cases, being rapidly exhausted.

When the last gun is fired we will be the owners of billions of dollars worth of mechanical and other equipment scattered all over the globe, most of which is scrap—that's all. If we drop this equipment where it is, some foreign nations will benefit, but most will not and we will lose billions of dollars worth of material taken from our stock of NOT INEXHAUSTABLE natural resources. If we bring it back and transform that part of it which cannot be used "as is" into new goods, there will be a resounding howl from the mining and metal refining industries and their allied unions, all of whom will predict a period of stagnation. The politicians who talk glibly and off handedly about "sixty million jobs," which are needed to keep up the present joy ride level of the country as well as to pay interest on money partly wisely spent and partly thrown away, will have a very bad headache. If we put that part of the war materiel which can be used by anyone on the market, give it to veterans or public institutions, etc., then more jobs go up in smoke and if we give it to foreign nations there will be still more trouble as their populations, other than those engaged in the building trades, will be walking the streets.

Actually some surplus is appearing on the market and most of it is being sold through dealers so that by the time it reaches the public it is not too cheap. The aircraft industry is due for a tremendous shrinkage—more perhaps than any other industry which is not purely a "war baby," yet it is politically weak and will be one of those to suffer the most unless steps are taken to protect it.

The Government is putting quite a number of war surplus trainers on the market. They will get men in the air quickly, and give the little airports which have been out of business for years something to work on, but it cuts down the postwar market for small planes just that many units and, still more important, is going to disgust many men with flying. An airplane is not unlike any other piece of machinery. It can run just so many hours before it is worn out and many fewer hours before it needs parts of work.

These surplus trainers, in many cases, have a good part of their useful life behind them and so they are sold cheaply just like a Rolls-Royce which has run 100,000 miles and is for sale for less than the price of a modest flivver. Joe Doak falls for the Rolls and drives it home. Ma Doak is enchanted —the Joneses are in the shade forever. Pa Doak even smiles a little at the boss and then it happens, he skids into a tree and needs some parts!

Just so with the expensive Army trainer with its high-powered engine as compared with the modest little flivver plane. Our aviation enthusiast puts most of his spare cash into the "bargain" and flies until he had an accident or is due for an overhaul. In the meantime the big engine which feels so grand has been eating up his cash in the form of gasoline in a way he had not expected and when he sees the price of those replacement valves, cylinders, bearings and pistons he sells the plane for whatever he is offered or scraps it and then curses aviation to everyone he can get to listen to him. Here is an educational job which everyone who wants to stay in the low-priced aviation field might well undertake before the potential golden goose is simply blasted into nothing before he even gets out of the egg.

New Planes

It has been evident for some time that the makers of combat single seaters are going to try to get out planes, engine equipped, to meet the challenge of the jet planes. The ships used in the war so far, were for the most part designed before our entry into it, but now the new models are popping out. One in particular is most interesting and shows how an old idea will pop in and out of the picture with improvements. This plane is nothing more or less than the old tailless flying Vee, of which the 1911 Dunne was a good example, driven by a pusher engine, but fitted with a small "canard" tail, if something sticking out in front can be called a tail. I am not in the confidence of the designer, but looking at the job it appears to be an attempt to make a plane which will be as stable inherently flying straight as the Dunne, which would take a lot off of the pilot's mind, and yet to be capable of being maneuvered quickly and landed certainly and not in the swoops which characterized the old machines. It certainly is an interesting job and I hope that it turns out to be everything the designers wished for.

I have just been going over the detailed specifications of the Lockheed Constellation, a most interesting big ship and one which merits the close study of every aviation man. The care with which details have been taken care of and the really high grade mechanical design of these details is remarkable. I happened to be at the Washington Airport with some Army friends when the first one sailed in from California in record time and it was really worth seeing. We Americans may not have all the answers when it comes to building small fighters, and I don't think that we do, but our large ships are without an equal in the world of aviation. Knowing this and realizing what is ahead in the postwar period should make us more alert than ever to keep our lead.

Chrome Plated Cylinders

I was at a technical meeting a few nights ago in which the subject of chrome plating aluminum cylinders was brought up. We all know how porous chrome plating has helped out in the big Diesel engine field and the speaker at this meeting stated that chrome lined aluminum cylinders were under test and showed promise. If this scheme really works out it will solve many of the very vexing problems of the very small aircraft engine.

Engined Gliders

It is interesting to note the increasing interest in the engined glider evidenced in a cross section of aircraft publications. AIRBRIEFS went into this subject quite thoroughly several times and its writer is really "sold" on the idea of the powered glider which will be the counterpart, in aviation, of the small sailboat which loafs about the bays of the country on sunny summer days. The flying of such a job would provide the most relaxation possible and bring many converts to flying.

Morris Field Artillery Tractor

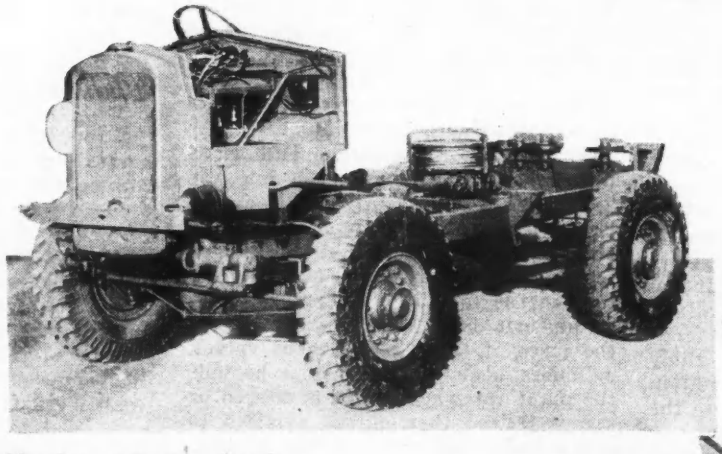
Power Plant and Cab Mounted on Special Cantilever Frame Located Above Main Frame

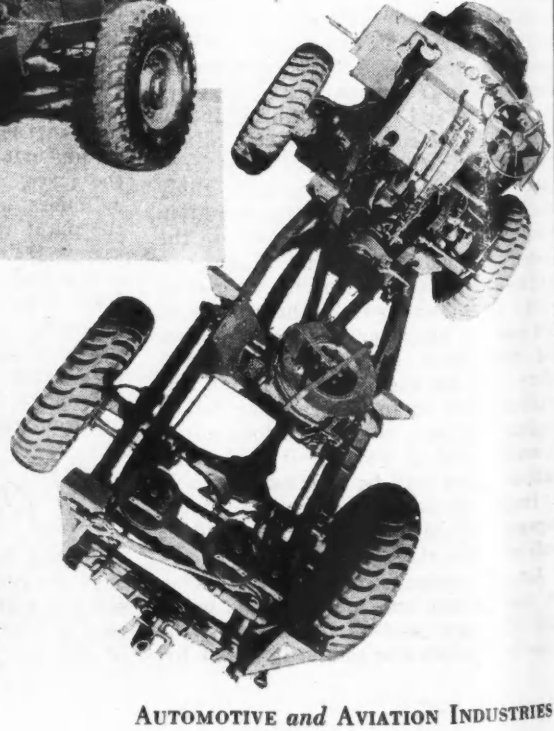
INFORMATION was released recently in England concerning a four-wheel-drive field artillery tractor produced by Morris Commercial Cars Co., a unit of the Nuffield Organization, to comply with a specification outlined by the British War Department. Among other features, it was stipulated that 40 per cent of the gross static weight should be carried by the front wheels, in order to secure the utmost benefit of four-wheel drive in cross-country operation. This stipulation was met by the use of a four-cylinder engine, located well forward relative to the front wheels in combination with a short wheelbase. Besides the high order of front wheel traction thus secured, the short wheelbase enabled another specified feature to be provided, i.e., a small turning circle to permit ease of maneuver in a restricted area.

As originally designed the chassis (known as the Quad) had independent front wheel suspension, but in order to secure large scale production with the minimum of delay by making the maximum possible use of existing jigs and tools, it was decided to incorporate the largest possible number of units of a previously standardized civilian type of chassis. This resulted in a conventional half-elliptic spring suspension being adopted fore and aft. To obviate the ill-effects due to excessive distortion of the chassis on uneven ground ordinarily associated with such a system of suspension in cross-country operation, a special form of cantilever frame with a three-point mounting on the main frame was devised to carry the power plant, radiator, front fenders, engine hood, the driver's cab and all controls. The main frame can therefore deflect and distort under the conditions mentioned without harmfully affecting the units specified.

The four-cylinder L-head engine, with a bore and stroke of 3.94 in. by 4.40 in., is constructed as a unit with the single-plate clutch housing, five-speed gearbox and a transfer gearbox, and is carried by the special frame at five points, three at the front and two at the rear, the latter two taking care of torque reaction.

(*Turn to page* 80, *please*)

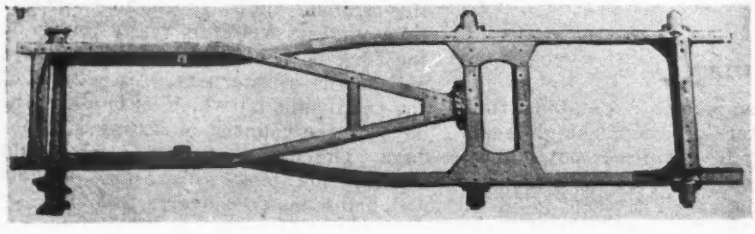




(Above) Morris gun tractor chassis.

(Right) Semi-plan view of Morris gun tractor chassis.

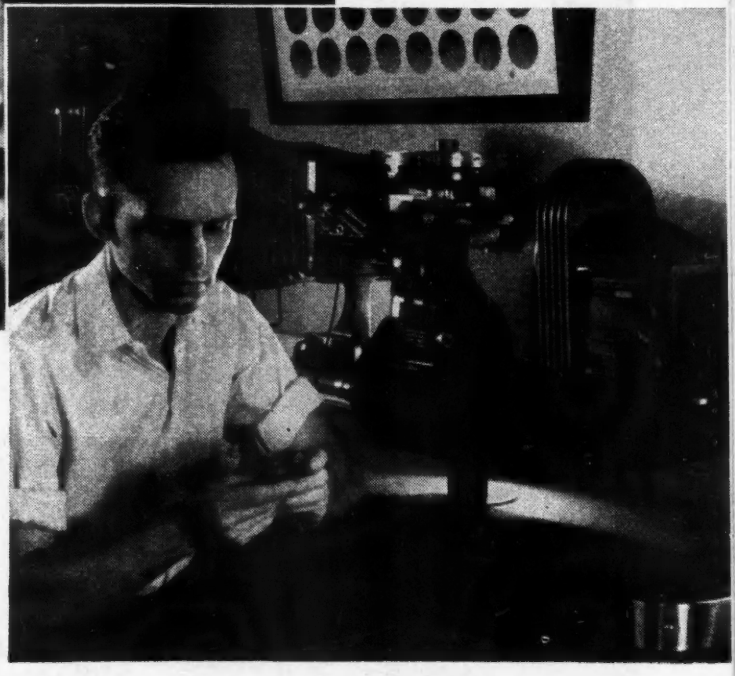
(Below) Chassis frame combining special cantilever frame and main frame.



Many test casts are made in Inland's search for new and better steels.

Invest in Victory—Buy More War Bonds and keep them.

Steel samples from pilot casts undergo photo-micrographic analysis.



New Inland Steels for Tomorrow

Inland makes steel in heats of a few pounds each for experimental purposes, and in production heats of 100 to 150 tons. The small experimental heats are run in two induction type furnaces, located in an especially equipped department of the main laboratory. These pilot heats are the forerunners of the steels for tomorrow.

Making small casts of steel is one phase of Inland's continuous research for better methods of producing steel, and for better steels *that* will make better products.

It is Inland research that already has produced low-alloy, high-yield strength Hi-Steel, and lead-bearing, faster machining Ledloy. The newest creation of Inland research is Ti-Namel—the new vitreous enameling alloy steel to which a white enamel cover coat is applied direct to the base metal. Ti-Namel assures superior quality finish, longer life, and lower shop costs.

These new Inland steels, and those that are yet to come, will be important to manufacturers competing in peacetime markets.

Bars • Plates • Floor Plate • Structurals • Piling • Rails • Track Accessories • Reinforcing Bars • Sheets • Strip • Tin Plate

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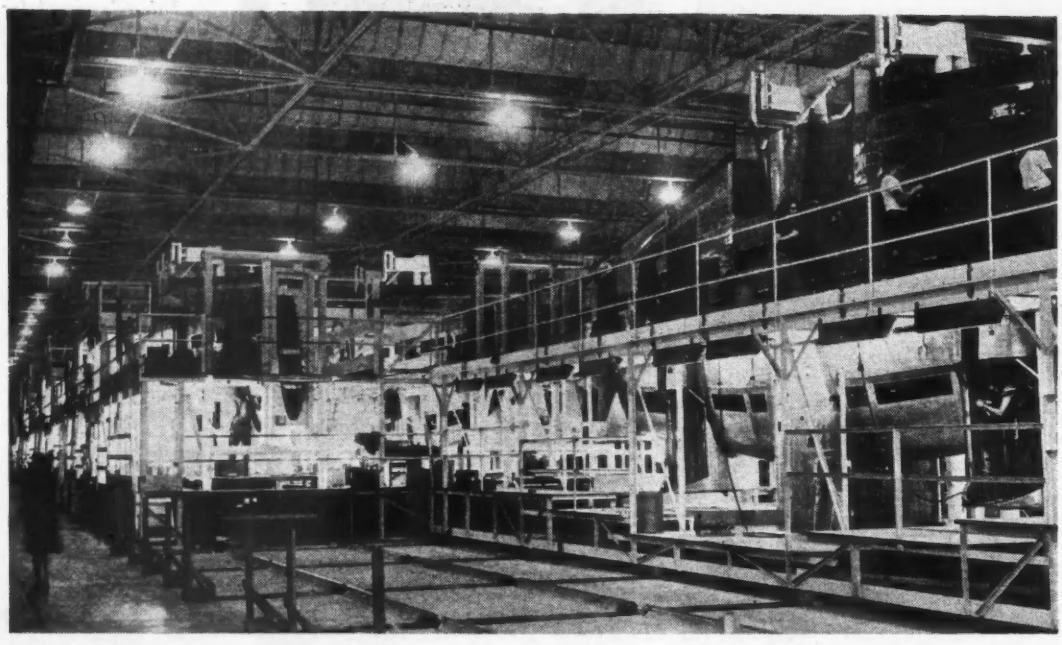
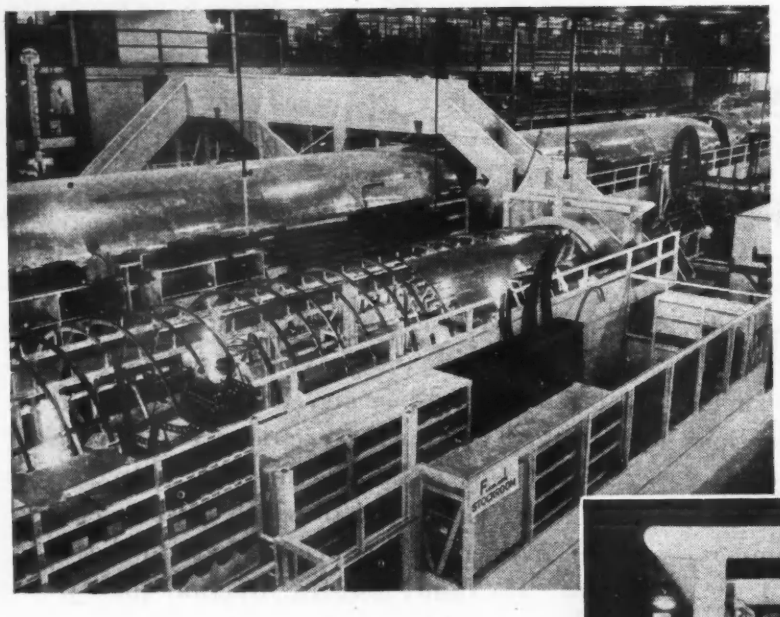
38 S. Dearborn St., Chicago 3, Ill.

Sales Offices: Cincinnati • Detroit • Indianapolis • Kansas City • Milwaukee • New York • St. Louis • St. Paul

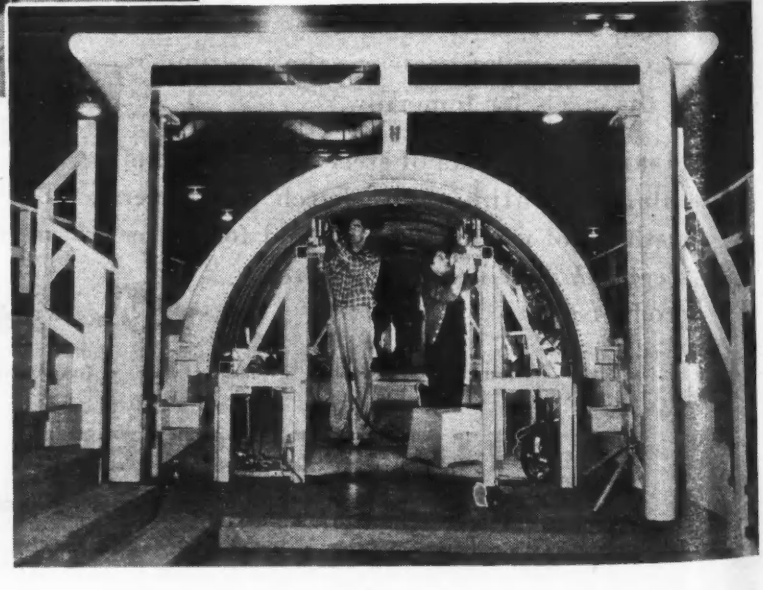


C-54 transport wings being built on moving assembly jigs. Note excellent lighting conditions in the lower - compartment working sections due to reflection of white paint.

Newly Painted Douglas C-54 Assembly Line



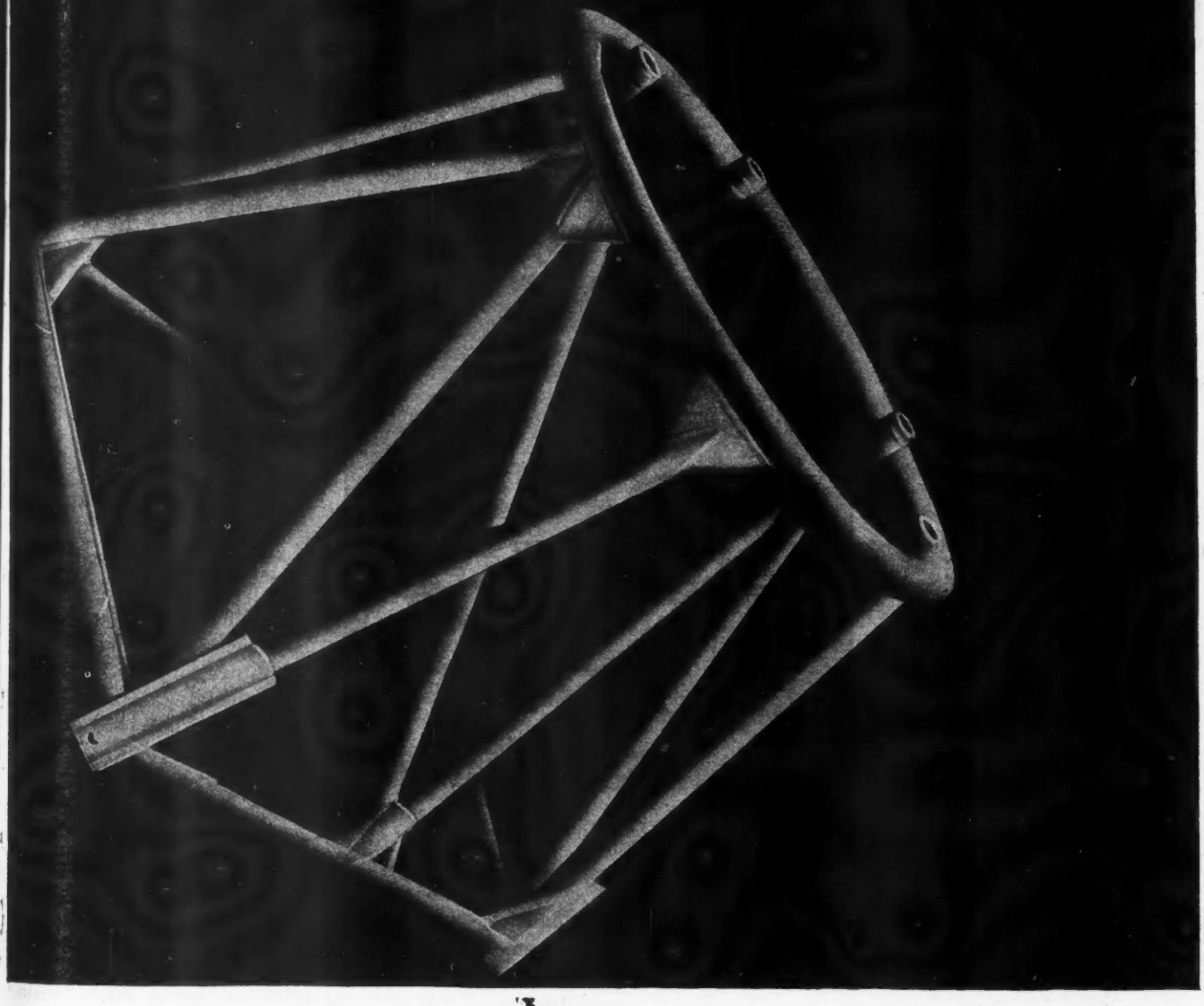
Lighting values in Santa Monica plant increased 50 per cent by use of cream-white paint on ceilings, walls and all parts of operating equipment. Formerly the color was battleship gray.



(Above) Stockrooms and parts bins are located along the new assembly line. White paint increases visibility, reduces shadows, reflects light in all directions and generally improves working conditions.

(Right) Construction of fuselage under well-lighted conditions. Note that fuselage is first built in upper and lower halves which are later assembled.

The excellent fatigue resistance of molybdenum steels has proved itself in aircraft structures over a period of fifteen years.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

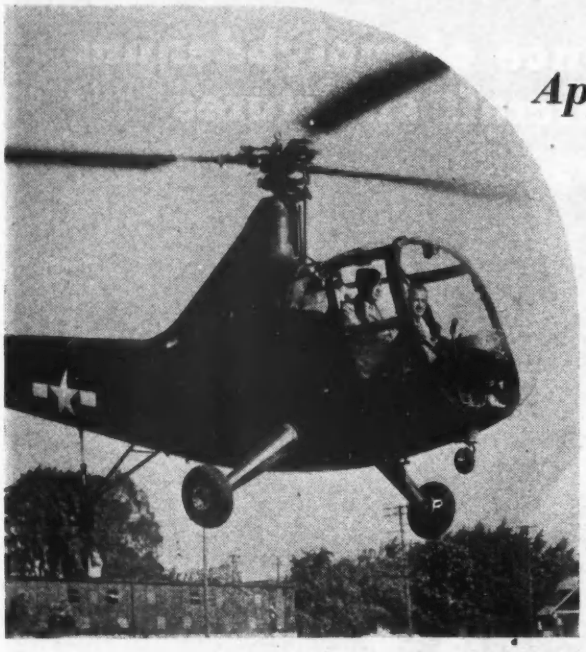
ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue • New York City

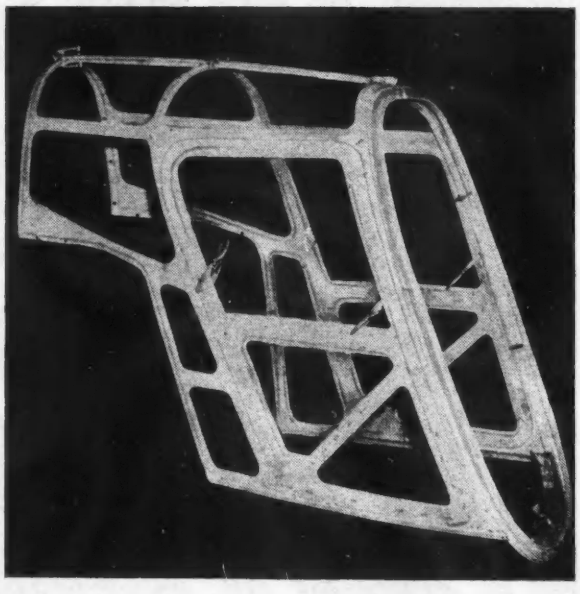
MOLY



Application of

Plastic Materials in Aircraft

Made of Fiberglas, laminated and reinforced with thermo-setting resin, this cabin structure for the R-6 helicopter is in quantity production at the Mishawaka, Ind., plant of the U. S. Rubber Co. The glass fiber laminate structure was developed by the Swedlow Aeroplastic Corp. at a saving of weight and meets specifications of the AAF Materiel Command. The Sikorsky-designed R-6 is being built by the Nash-Kelvinator Corp. at its Detroit plant. The cabin is covered with Plastiply panels produced by the Haskelite Mfg. Corp.



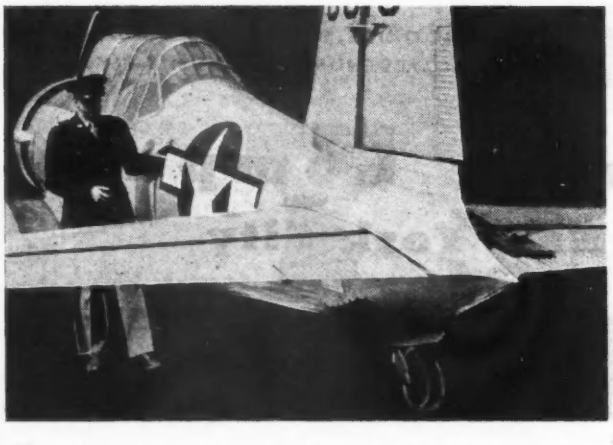
By O. R. Hoeltzel

Process Engineer,
Fort Worth Division,
Consolidated Vultee Corp.

THE common aircraft engineering practice today is to divide all materials into two groups —structural and non-structural. The former group includes those materials which, due to their physical characteristics, are satisfactory for primary as well as secondary structural applications, and the latter group those materials whose physical characteristics make them suitable for decorative or utilitarian applications only. For simplicity the following discussion will be divided in this manner.

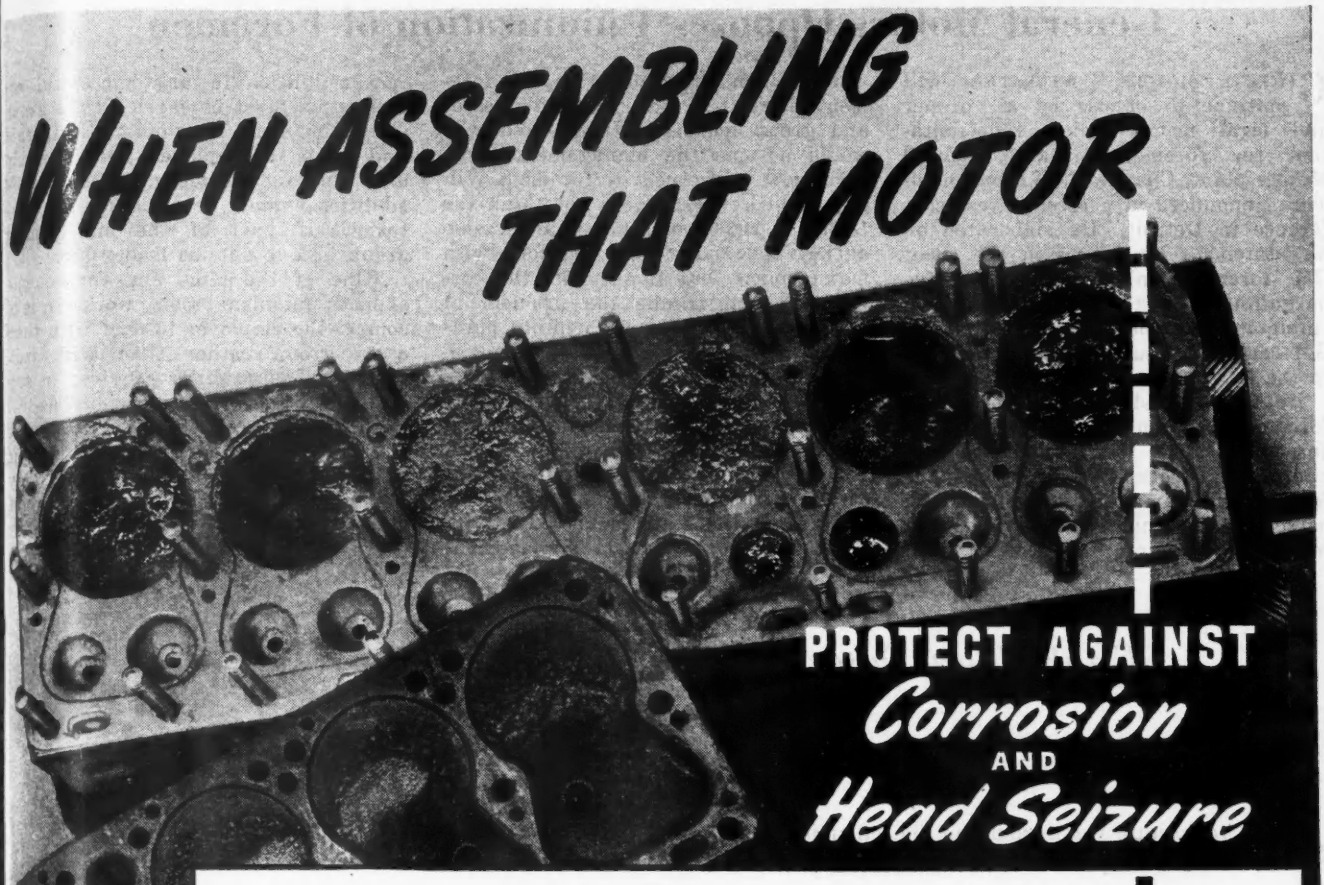
Structural Applications—The use of plastic materials for structural applications has been limited because of the low strength, lack of resilience, and the brittle nature of pure resinous materials. A solution for some types of plastics parts was the use of various fillers depending on the qualities needed. For example, macerated fabric was added to increase the impact strength or mica was added to increase electrical and heat-resistant qualities, etc. This solution was quite satisfactory for small molded parts, non-structural in nature, but obviously not the answer for structural parts. Even the use of heavy cotton duck laminated with a resin material was not the answer; although these laminates were highly satisfactory for use as abrasion resistant sheet and for other uses already mentioned, their low tensile and compressive strength and unimpressive

(*Turn to page* 112, *please*)



Fuselage rear section, tail cone and side panels of this experimental version of the BT-15 trainer were made of plastic composite by engineers of the Air Service Technical Command at Wright Field and the structure is reported to be 50 per cent stronger than a metal fabrication and 80 per cent stronger than a wooden fuselage on a strength-weight basis. Construction is the sandwich type consisting of a balsa wood core with inner and outer layers of plies of glass cloth impregnated with resin. A laminated plastic fuselage and wings for the BT-13 fabricated by similar principles but different techniques and materials is another project under way at Wright Field.

WHEN ASSEMBLING THAT MOTOR



PROTECT AGAINST *Corrosion* AND *Head Seizure*

Corrosion quickly attacks many types of cylinder head gaskets. It eats into engine blocks. It ruins cylinder heads, particularly aluminum heads.

Prevent corrosion . . . water seepage . . . loss of compression . . . head seizure.

Apply Permatex Aviation Form-A-Gasket to both sides of cylinder head gaskets and over entire surface of stud bolts. It will produce a non-drying, elastic, adhesive, heat-resisting, non-corrosive seal.

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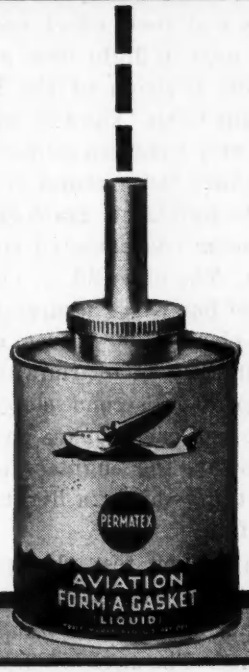


FORM-A-GASKET NO. 1

Fast drying and hard setting. Used principally for making permanent assemblies, for building up uneven or warped surfaces and for the repair of broken parts. Makes unions leakproof to gasoline, gasoline vapor, kerosene, hot or cold oil, grease and water. Resists highest pressures and greatest strains.

FORM-A-GASKET NO. 2

Dries slowly and remains pliable. Used for general assembling work on all types of gaskets, flange surfaces and screw thread connections. Like Form-A-Gasket No. 1, it makes leakproof, pressure-tight unions but disassembles very easily. Preserves all types of solid gaskets from heaviest metal to thinnest cork.

General Motors Opposes Unionization of Foremen

GENERAL MOTORS CORPORATION will continue to oppose by all proper and legal means union representation for foremen in any General Motors plant, Charles E. Wilson, president, announced in a recent press conference in Detroit. He elaborated on his statement by saying in the event GM foremen unionize for collective bargaining in line with a recent NLRB ruling that foremen have such a right, GM certainly would contest the ruling in the courts.

He also stated that in the event foremen reunionized, GM will be forced to alter its fundamental organizational setup by depriving the foremen of their authority to deal with personnel and union matters and with other functions of management. This would mean reclassification of foremen's duties to a status of straw bosses and group leaders. When asked who would assume the management functions now performed by foremen, Wilson replied that he does not think the 18,000 to 20,000 will choose an outside agency to handle their relations with management, but if they do, the corporation will handle the problem at that time. There are no definite plans as yet for a new strata of management, he said.

Wilson stated that GM has sent to all members of management, including foremen a statement outlining the corporation's policy on the unionization of management. Following are quotations from the statement:—

"It is obvious that the management responsibilities in any successful organization must be carried by a group of capable men. They must select, train and promote employes and maintain discipline and efficiency. These responsibilities cannot be satisfactorily performed if part of the management group look to outside leadership.

"One of the aims and consequence of mass unionism among workmen is to compel the employer to deal with them as a group rather than with individuals. The qualities required in successful managers are individual ability, initiative and cooperation. It is these qualities that raise the value of their services above those of the people they supervise. Therefore, any member of management who requires an outsider

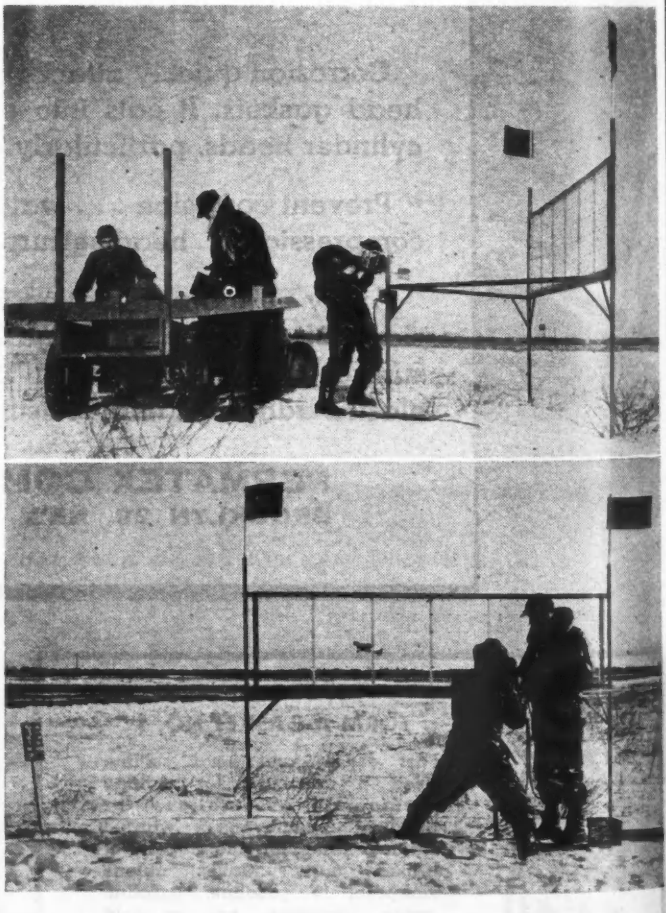
(*Turn to page* 109, *please*)

Flight Test Data Obtained by

New Method

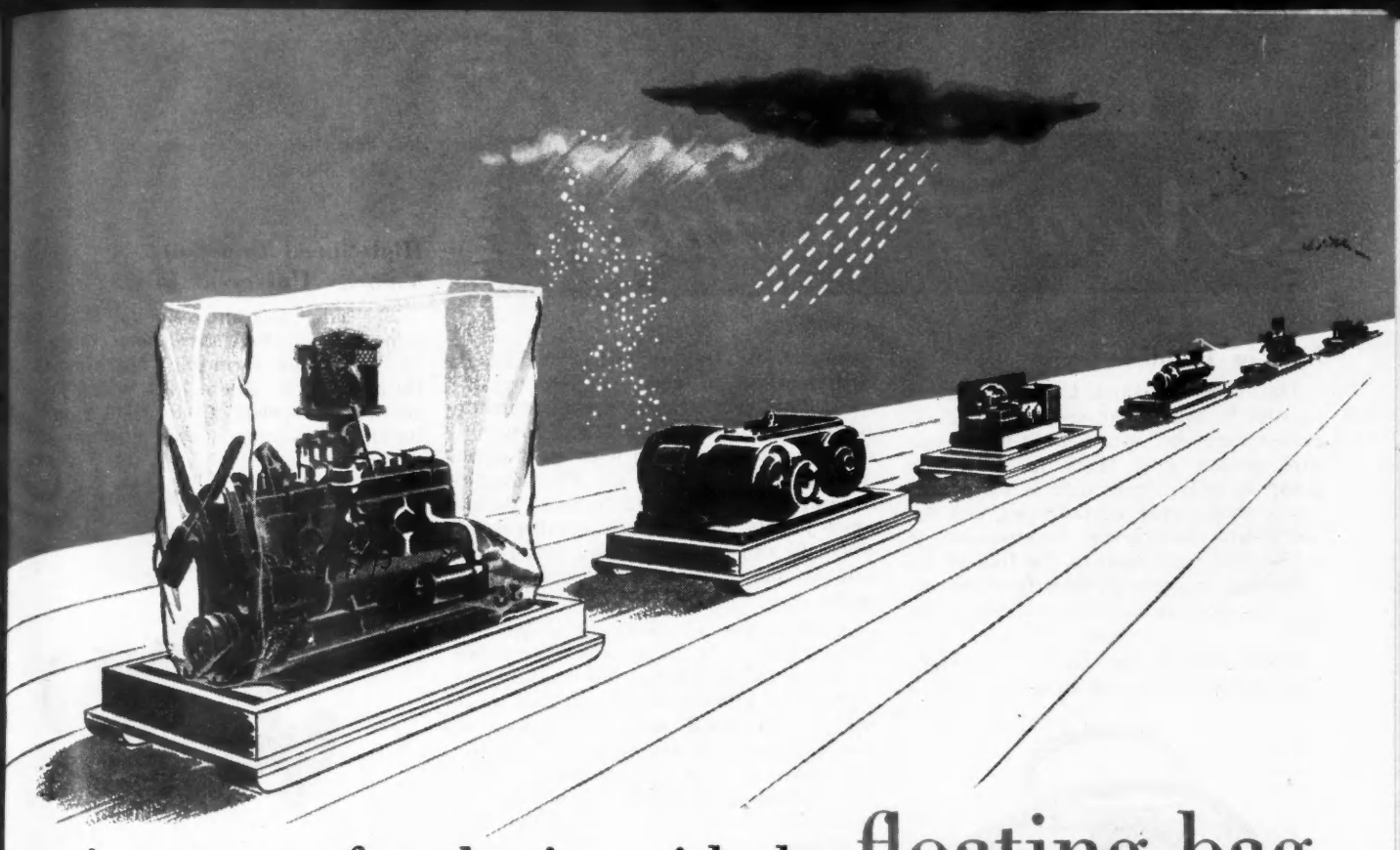
A NEW technique for measuring the efficiencies of engine-propeller combinations on airplanes and their effect upon its performance is being used in flight tests at the Ranger Aircraft Engines Division of the Fairchild Engine and Airplane Corp. The test equipment consists of a Bolex movie camera coupled to an intervolometer set to take four frames per second and a screen grid to provide a graph-like series of pictures. The camera is mounted rigidly 5 ft behind the screen. The grid, 30 in. high by 120 in. long, is made of fine wires accurately spaced 1.2 in. apart. When placed 1000 ft from a runway, each square measures 20 ft of runway. Knowing that one quarter of a second elapses between each exposure and each square on the grid covers 20 ft of runway, the engineer can readily determine many things about a flight from the motion picture of it.

In a take-off test, the length of the airplane's ground run can be measured, the acceleration rate can be determined and its rate of climb ascertained. The angle of climb is shown by a black stripe painted along the centerline of the plane. Used to gather landing data, the technique shows the landing speed, rate of descent, angle of descent and ground roll. By measuring the glide path with engine throttled, it is also possible to determine the lift/drag ratio of the airplane. The same technique can be used for measuring speed runs. In practice, the film shot during a test is projected and a graph is drawn from it. By comparing such graphs the efficiencies of the various propellers can readily be compared.



(Top)—Setting up camera and grid in preparation for a take-off test.

(Bottom)—Photographing a take-off. The squares of the grid create a graph-like record on the motion picture of a take-off test.



moisture proof packaging with the floating bag

First designed for war shipments, the "floating bag method" of packaging with Saran Film holds many advantages for wide peacetime service.

This advance in packaging is as simple as it is effective. Essentially, it consists of placing metal parts or assemblies in a bag of Saran Film provided with gasketed holes suitably located to permit attaching the unit to a cradle. When the unit is mounted, the desiccant is added—excess air is evacuated and the bag is sealed. The result—a tough, moisture vapor-proof envelop affording protection against corrosion, dirt, dust, grease, and grit. Adaptable for the protection of units of various sizes, shapes, and weights, the floating bag package is easy to handle and quickly unpacked. Write for further details.

Saran film

KEEPS MOISTURE IN ITS PLACE

PRESENT AND POTENTIAL USES: Method II packaging, dehydrated packages for metal parts and assemblies, packing corrosive and anhydrous chemicals, bottle closure liners, flexible containers requiring good moisture vapor and gas impedance, etc. Shows much promise as important visual sales aid.

PROPERTIES AND ADVANTAGES: Highest degree protection against moisture vapor transmission; three times greater than comparable materials. Soft, pliable, yet tough and strong. Corrosion-resistant. Clear, transparent film. Modified heat sealing equipment recommended. Thickness range .001 to .003 inch.

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PLASTICS

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SARAN • SARAN FILM • STRIPCOAT

New Products

Lincoln Handi-Luber

The Lincoln Handi-Luber makes it possible to convert an ordinary original grease container into a 25-lb high-pressure grease gun. Low in cost, and great in utility, this unit is suited for use in shops, mills or factories, and for lubricating contractors' equipment. It is the latest addition to the line of lubricating equipment manufactured by th Lincoln Engineering Co., St. Louis, Mo.

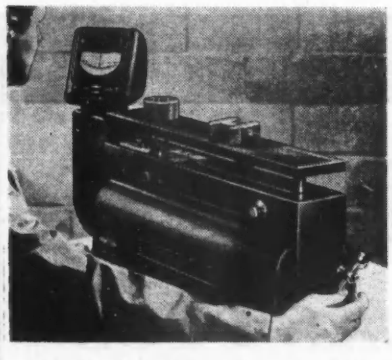
Model 1266 Handi-Luber is a high-pressure grease pump equipped with a

Handi-Luber made by Lincoln Engineering Co.

5-ft hose assembly with hydraulic coupler for contacting all Kleenseal and hydraulic fittings. Manually operated, it dispenses either light cup grease or viscous types; and easily develops 5000 psi pressure.

Instrument for Measuring Internal Dimensions

The Model N-5 internal measuring instrument announced by The Sheffield Corporation, Dayton, Ohio, embodies both mechanical and electrical principles. This comparator type instrument for the precision measuring of internal dimensions is equipped with an electric gaging head known as the Electrigage, an amplifying device (2500 to 1) developed jointly by research engineers of Sheffield and Westinghouse. Other amplifications may be had on special order.



Model N-5 internal measuring instrument

A new type of electrical magnification causes instantaneous action of the indicator hand. There is no lag, and the stylus has a feather touch so that gaging pressure need never exceed 3 oz. A fine adjustment knob is used in obtaining a zero setting. An automatic stabilizer prevents ordinary voltage variations from affecting accuracy of the readings.

Precision blocks or masters are used as a reference in setting up the instrument. A limit switch arrangement operating two red signal lights assists the operator in making the set up and in properly positioning the work for checking.

American Hammered Offers New Tractor Piston Rings

A new and more complete tractor piston ring line is now available to distributors and jobbers of American Hammered Piston Ring Division of Koppers Company, Inc., Baltimore, Md. In addition to a much broader coverage, the line now consists of both conventional type sets for rebore jobs, and flexible type sets for re-ring installations.

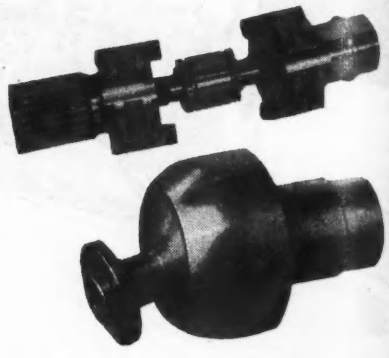
Forty-four TC (tractor conventional) sets cover a range of approximately 75 of the more popular tractor engines, whereas the TF (tractor flexible) sets offer a range coverage of 55 engines.

Chip Plow Makes File Cleaner More Efficient

The Cincinnati Tool Co., Cincinnati, Ohio, has placed on the market the Hargrave file cleaner with chip plow which quickly cleans a file of soft metal chips. A special square-shaped plate is fastened to the frame of the company's standard file cleaner. This plate is made of soft steel, and is used by striking the edge on the file to be cleaned, thus impressing the tooth pattern on the edge. The plow is then pushed parallel to the file grooves. It plows out the imbedded chips and dirt. When a file of different tooth spacing is to be cleaned, a new edge of the plate is used. Non-metallic dirt is removed by the regular file card.

High-Speed Constant Velocity Universal Joints

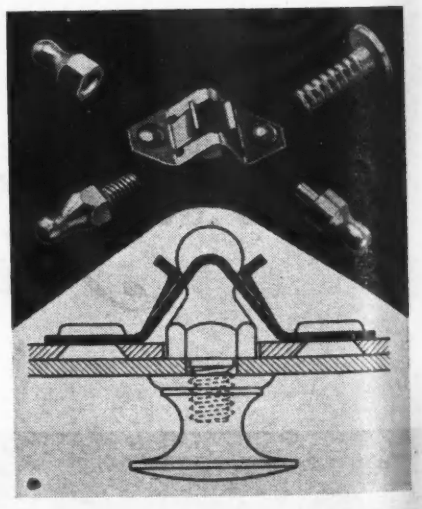
The two constant velocity universal joints illustrated have been designed by The Gear Grinding Machine Co., Detroit, Mich. These high speed joints operate at speeds up to 9000 rpm between shafts subject to a maximum de-



viation from normal of 6 deg. At all speeds and at all angles of deflection these joints deliver to the driven member the same constant speed of rotation that is provided by the driving member.

Spring-Steel Latch

Tinnerman Products, Inc., Cleveland, Ohio, has originated a new spring-steel Speed Nut Latch, the No. 1663, for instant attachment and removal of box covers, access doors, panels and inspec-



Tinnerman Speed Nut Latch

tion plates. The spring arms of the Speed Nut snap over ball or grooved studs to provide firm attachment, yet studs may be quickly withdrawn. The Speed Nut is available in five material thicknesses to provide the desired degree of pull-out tension. Three styles of ball studs are available, drilled and tapped for 6-32 screws, threaded shank

(*Turn to page* 102, *please*)

WHEN THE FIGHTING IS FINISHED . . .
the largest and best manufacturing facilities in all Sealed Power history will be at your service. Meanwhile, Sealed Power engineers invite you to use their experience and the unequalled resources of Sealed Power laboratories to help make your good engines even better.
SEALED POWER CORPORATION
Muskegon, Michigan • Windsor, Ontario
Buy More War Bonds—And Keep Them! Pay $3—Get $4!
SEALED POWER

Checking shape characteristic of ring by radial pressure.

SEALED POWER PISTON RINGS

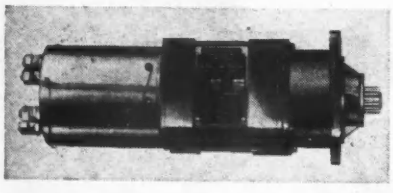
PISTONS — CYLINDER SLEEVES

New Products for Aircraft

Wing Flap Drive Unit

Electrical Engineering and Mfg. Corp., Los Angeles, Cal., has designed a wing flap drive unit for use on the Douglas A-26 attack bomber. It is custom built throughout for special operating, mounting and maintenance conditions. In addition, the completely self-contained unit has to meet stringent weight specification.

The 2-hp, 7500-rpm motor is equipped



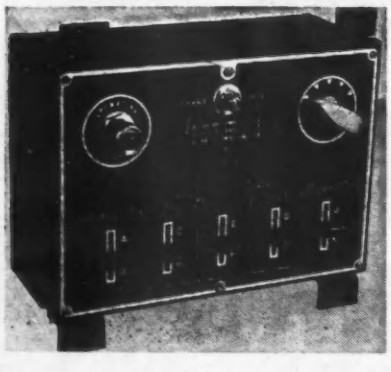
Wing flap drive unit made by Electrical Engineering and Mfg. Co.

with a magnetic clutch and brake. It is thermally protected, and protected additionally against exposure to dust, sand and salt spray. Designed for low impact torque, the unit cannot be damaged by overtravel resulting from failure of electrical stops.

Electronic De-Icer Timer

The Eclipse electronic de-icer control, made by Eclipse-Pioneer Division of Bendix Aviation Corp., Teterboro, N. J., controls the de-icer system for rate of ice accretion and texture of ice formation.

The electronic timer is designed for use in conjunction with the manifold-solenoid de-icer system, and provides automatic or manual remote electrical control of de-icer boot operation, opening the boot inflating valves automatically, in the proper sequence, and for the effective time intervals. Control of the de-icer system for very light icing, light to moderate icing, severe icing and high altitude conditions is successfully accomplished.



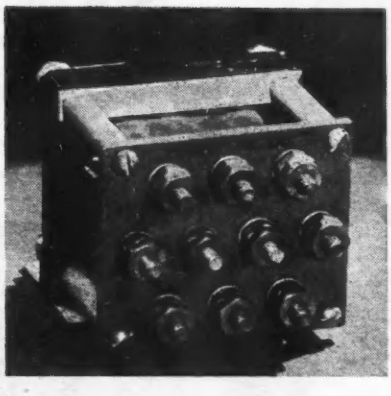
Eclipse electronic de-icer control unit

Although primarily designed for new aircraft, any manifold-solenoid de-icer system now using the Eclipse mechanical timer can be inexpensively and quickly converted to the electronic de-icer timer and the mechanical timer eliminated, by merely changing the AN connector on the existing cable.

The electronic de-icer timer can be wall or flush panel mounted. It is so designed that it may be opened for inspection from the front while in operation, or for complete removal from the case. The unit weighs 6.5 lb.

Transformers for Aircraft Lights

Two new 115-volt, 400-cycle, single-phase transformers, designed to operate 6-volt aircraft-instrument lights, have been brought out by the General Electric Co., Schenectady, N. Y. With an output capacity of 30 volt-amperes, either of these units permit simul-



G-E tapped transformer for operation of aircraft lights

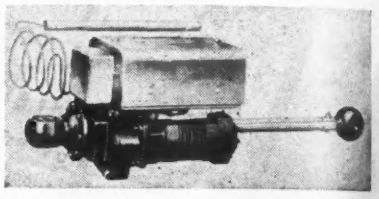
taneous operation of 25 lamps at full brilliancy.

One of the transformers is provided with taps which facilitate the preselection of any desired light level within the unit's range of 6 to 1.74 volts. The taps are so arranged that each successive voltage reduction approximately halves the previous candlepower output of the lamps. Taps are not provided on the other unit but any desired light level can be maintained by using a potentiometer to vary the transformer voltage.

Both transformers are small and light in weight—the tapped unit weighing 1 lb. and the other 0.8 lb.—and were designed for convenient mounting and connecting. The mounting clamps are protected against corrosion and the terminal boards are constructed of vibration—and shock-resistant material.

Lightweight Electric Linear Actuators

The new, light, Lear Model 400 Series of linear actuators, weighing as little as 3.05 lb., have been built specifically to meet the demand of the aviation industry for an efficient method of converting electrical energy into linear actuating force with the least possible weight and size, yet giving all the required strength and power.



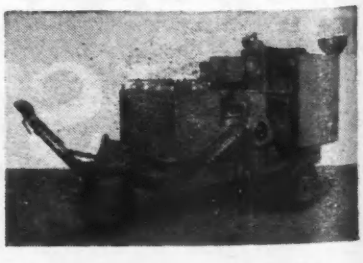
Model 400E Lear linear actuator

These "400" actuaters are designed to operate under loads up to 400 lb. of compression or tension. They require 24-28 volts, and are said to draw an extremely small amount of current. In size, the "400" model is less than five in. wide, and less than seven in. long, including the limit switch control box and the thermal protector. The extension length ranges from 14⅞ in. to almost 25 in.

Portable Aircraft Engine Oil Filter

The Hilliard Corporation, Elmira, N. Y., announces its new Hilco Hyflow portable aircraft engine oil filter. Used lubricating oil is drained directly from the aircraft engine into a dirty oil tank. A gasoline engine driven pump withdraws oil from this tank, forces it through the automatically controlled gasoline heater to preheat the oil before passing through a battery of large filter elements. The filtered oil is delivered to the clean oil section of the tank. The gasoline engine also drives a large pump to withdraw the oil from this tank and deliver it directly back to the aircraft engine. A meter is installed in the clean oil line for measuring the oil going back to the engine through the length of hose and nozzle.

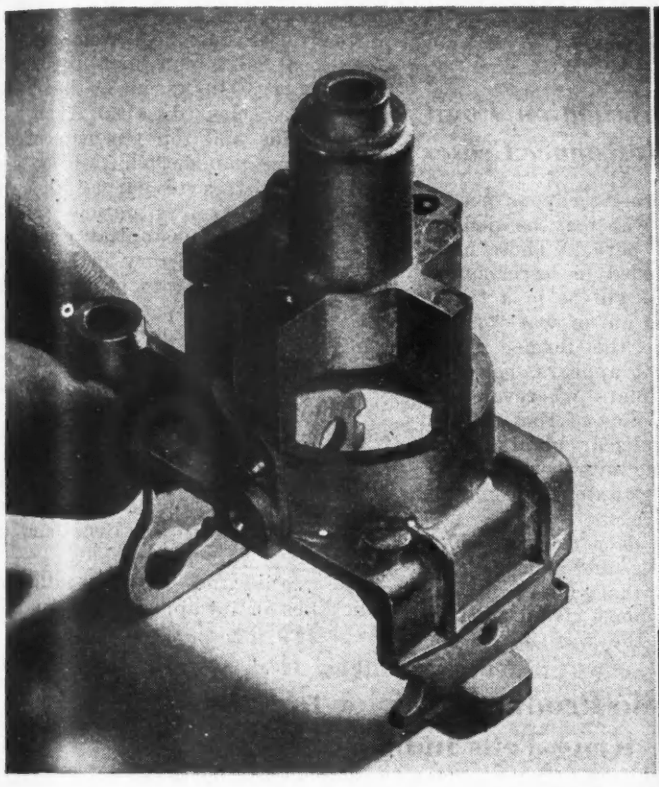
(*Turn to page* 110, *please*)

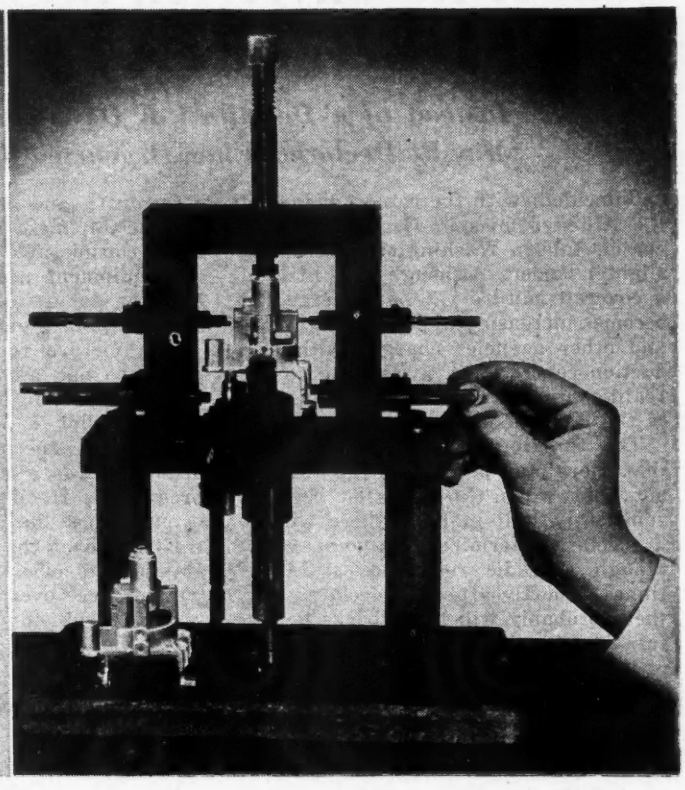


Hilco portable engine oil filter

ACCURACY!

—EXACTING PRECISION AT 60 POINTS ON THIS ZINC ALLOY DIE CASTING





This zinc alloy die cast speedometer frame must pass the critical test of the master gage shown at the right. 24 plug gages are used in this fixture to check approximately 60 dimensions of the casting. When it is considered that the specified *cast* tolerances run as close as ± .002" in a dimension of 1.007" between hole centers on two different planes, this casting becomes a testimonial to the dimensional accuracy of zinc alloy die castings.

Dimensional accuracy is not the only reason why this speedometer frame is die cast. There is no other means of production which could achieve such complexity of design in one piece. Think of the savings in machining and assembling operations—the savings in over-all cost! Furthermore, as a zinc alloy die casting this part possesses the required strength to assure efficient performance.

It is this unique combination of advantages which make die castings of zinc alloy the most widely used. *Every die casting company is equipped to make zinc alloy die castings,* and will be glad to discuss each of these advantages with you—or write to The New Jersey Zinc Company, 160 Front Street, New York 7, New York.

ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are specified with
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

Talk of Reconversion Becomes Bolder as Germany Fades Out

Instead of a Definite V-E Day, Termination Point May Be Declared When Organized Resistance Ceases

Coincident with the rapid advance of the Allied armies in Germany, reconversion talk in Washington is becoming slighter bolder. Although very little of a concrete nature yet has emerged, it becomes increasing apparent that WPB and other agencies charged with production controls are awakening to the realities that will accompany the end of the German phase of the war.

The thinking now prevailing holds that there may be no definite V-E day but that when the situation becomes sufficiently well in hand there will be a declared termination point, even though sporadic resistance still continues. Shortly after the declared day, there probably will be cutbacks in certain items not needed for prosecution of the Japanese war. Other items which will be needed, but in lesser numbers, probably will be cut back moderately at first with later reductions dependent on the progress of the war. The overall picture will show a small cutback in the early weeks, tapering off 35 to 50 per cent by the end of the first year, according to present predictions.

Of particular importance to the automobile industry will be where the cutbacks fall. Trucks, for example, will be needed for transport in China. Some tanks will be required also, although the number may not be so great as was used in the European theater. According to present estimates, aircraft (of certain types), anti-aircraft guns and anti-tank guns will be required in smaller quantities. Thus, companies tied up with trucks, tanks, certain types of aircraft, and other weapons needed for the Japanese war may be tied up for a considerable period. Those making equipment needed in lesser quantities or not at all will be in a favorable position to get out of war work.

The picture for the former group is not so bad as it appears, however, WPB at present plans wherever possible to follow a policy of routing war work into specialized plants built primarily for a definite type of war production, freeing automobile plants in every possible case.

Evidence of the deep concern which government officials and some industrialists feel over the possibility of a severe break in home front morale after the end of the war in Europe is seen in the outline of policy sent by Paul G. Hoffman, president of Studebaker Corp. and chairman of the Committee for Economic Development, to 2200 local CED chairmen throughout the country. In essence, the policy, which was cleared with Army and Navy heads and top government officials before publication, calls on local CED committees to survey their respective industrial situations and, if they find that substantial unemployment will follow victory in Europe, to increase goals for prospective civilian production. While conceding that unquestioned priority must be given the war effort for both the German and Japanese phases, the letter states that V-E day will bring cutbacks and considerable immediate unemployment which, if allowed to continue for too long, might seriously impede the Japanese war and result in unnecessary sacrifice of American lives and resources.

The significance of the outline of policy lies in its approval by top mili-

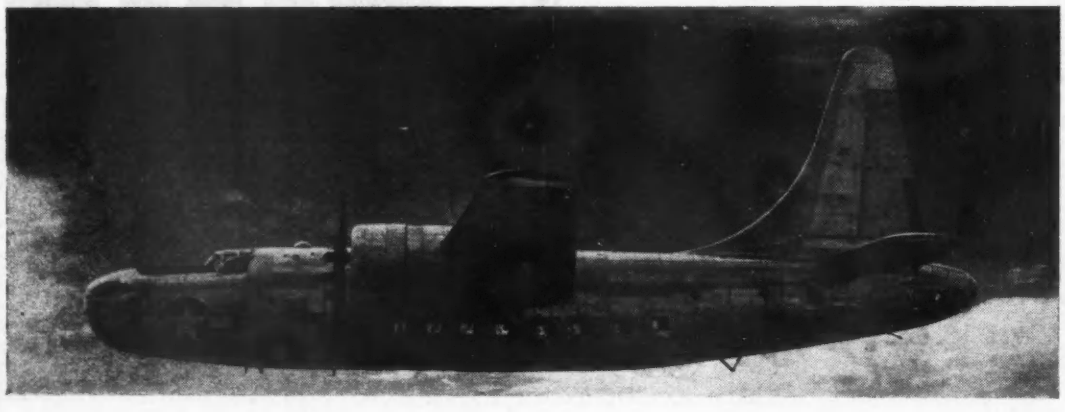
(*Turn to page* 60, *please*)

No Automobile Production Prior to Fall Of Germany, Krug Tells Industry

Definitely refuting a published report that production of automobiles had been authorized on a quota basis for the last quarter of this year, J. A. Krug, Chairman of WPB, told leaders of the automobile industry at a meeting in Detroit April 5 that no car production will be allowed prior to the fall of Germany and perhaps not for a short time after that. "The full productive resources of the nation are needed for war production," he said, "with the result that even some very necessary preconversion activities may have to wait until V-E day."

At the meeting, attended by top staff members of WPB, the full membership of the Board of Directors of ACWP and representatives of the Office of War Mobilization and Reconversion, WMC and the Army and Navy, industry leaders agreed with Government and Military men that war programs must be the first consideration until the end of both wars. They did, however, discuss in considerable detail the planning and preliminary steps that must occur to permit smooth and prompt reconversion when war contracts are substantially reduced.

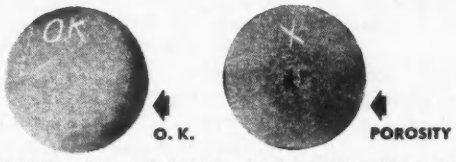
Krug announced that WPB has established in its Detroit Office a staff



RY-3 Transport Plane

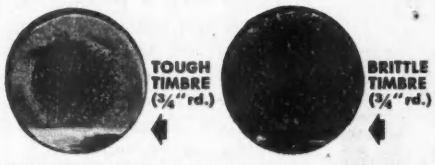
This new plane, made by Consolidated Vultee Aircraft Corp., is a transport version of the Privateer PB4Y-2 navy patrol bomber. It has a wing span of 110 ft and is 75 ft in length. Powered by four 1350-hp Pratt & Whitney engines, its maximum speed is over 250 mph and its range is in excess of 3000 miles.

How These 5 Tool Steel Developments Help You Cut Costs & Boost Output Per Tool . . .



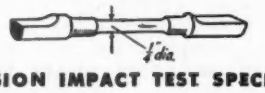
ONLY SOUND, CLEAN STEEL CAN PASS THIS TEST

1. Insurance that Matched Tool Steels are internally sound lot after lot is provided by Carpenter's Acid Disc Inspection, standard practice for over 15 years.



BOTH BRINE QUENCHED AT 1550° F.

2. To assure a wider safe hardening range, greater dependability in performance, Carpenter introduced the Tough Timbre Test in 1930.



TORSION IMPACT TEST SPECIMEN

3. More complete heat treating information that leads to better tools has resulted from the Torsion Impact Test, developed by Carpenter more than 10 years ago.

4. The Carpenter Matched Set Method of selecting the proper tool steel for each job has been used in thousands of tool rooms since 1935. It's a sure-fire way to cut unit costs with tools that stay on the job longer.

CONE TEST SPECIMEN

5. To check and control the hardenability of water-hardening Matched Tool Steels, Carpenter has recently developed a special Cone Test. This test assures that bars of the same size will have uniform hardness penetration in shipment after shipment.

All 5 WITH CARPENTER MATCHED TOOL STEELS GIVE YOU REDUCED COSTS AND BETTER TOOLS!

Tool makers who use the Carpenter Matched Set Method of selecting tool steel, cash in on the advantages provided by each of these developments. With Carpenter Matched Tool Steels you are sure of—

- **Uniformity from lot to lot**
- **Improved heat treating results**
- **Easier selection of tool steel for each job**
- **Faster tooling-up**
- **Reduced machine shut-down time**
- **Lower production costs**
- **Fewer rejects**
- **Increased plant output**

And these advantages are *yours* when you put the Matched Set Method to work in your tool room. To find out more about this method and what it can do for you, just drop us a note on your company letterhead. We will be glad to give you a copy of the 167-page *Matched Tool Steel* Manual. It contains an 80-page Tool Index and Steel Selector, plus useful heat treating information that will be of special value to men responsible for tooling and tool production. This Manual is offered free to tool steel users in the U. S. A.

The Carpenter Steel Co., 103 W. Bern St., Reading, Pa.

Carpenter MATCHED TOOL STEELS

of experts headed by Henry P. Nelson, Director of the WPB Aircraft Division, to coordinate activities of the industry and Governmental agencies in developing the various preparatory steps which must be completed before peacetime production can be resumed. Nelson's first move was to investigate personally the individual problems of each car manufacturer and report his findings back to Krug as a basis for setting policy.

Krug explained that readjustment of contracts will aim at giving all companies as nearly an equal chance as possible to get out of war work at the same time. He warned, however, that the nature of certain war work might tie up some companies longer than others because of the critical nature of the product and the impossibility of moving it to another plant. In such cases, he said, the companies could arrange for other facilities to carry on car production. George Romney, Managing Director of ACWP, added that the industry was not asking that all companies be assigned identical starting dates on car production, but that all receive the same treatment insofar as that is possible.

Krug stated that WPB expects shortly after V-E day to permit ac-

(*Turn to page* 82, *please*)

Dezendorf Outlines Postwar Sales Plans

A great deal of hard work and intelligent salesmanship will be required to sell the 15 million automobiles that comprise the expected postwar assured market, according to Nelson C. Dezendorf, director of the distribution staff of General Motors Corp. The 15 million total is obtained, he said recently, by adding the current demand to the million car estimated postwar backlog demand.

A survey of buying habits over a 10-year period shows that about seven million persons bought new cars and turned them in after driving them an average of 2½ to 3 years. If government controls limit production to about two million cars the first year, the car population would not be increased because such a production would merely offset normal scrapping, he said.

"During the following three years, annual production would be limited only by the capacity of the industry to produce. Assuming that plant capacity would be increased 50 per cent over 1941, about six million cars would be built per year. At this rate, the customary new car buyers would be supplied in less than a year and a half, even though an assured market for 15 million cars existed. The reason is that in normal times, the market is supplied by both new and used cars, but following the resumption of production only new cars will be available in large quantities."

Mr. Dezendorf has outlined a two point program for achieving a 15 million car potential market in the postwar period. The customary new car buyer must be persuaded to hold his car a shorter time before trading it in on another new one, and a larger number of customary used car buyers must be induced to buy new cars.

Vincent Bendix

Vincent Bendix, 63, founder of the Bendix Aviation Corp. and president of Bendix Helicopters, Inc., died March 27 at his home in New York, N. Y. He was widely known for his many inventions which included the Bendix starter drive used on an estimated 65,000 vehicles. Mr. Bendix introduced into the United States the first volume production of four-wheel brakes.

After nearly thirty years of manufacturing automotive accessories, Mr. Bendix established the Bendix Aviation Corp., engaging in the manufacture of airplane instruments, brakes, radio landing apparatus and other devices for use on aircraft.

Mr. Bendix resigned from the Bendix Aviation Corp. in March, 1942, and in June, 1944, formed Bendix Helicopter, Inc. According to an announcement late last year, the company had developed a four-passenger helicopter sedan for postwar production.

SHEER STOPPING POWER
Right from the word "GO!"

With GRIZZLY *Moulded Brake Lining*

FOR EVERY AUTOMOTIVE BRAKE REQUIREMENT

Right from the word "GO!"—from the exclusive Grizzly asbestos-friction compounding right through the moulding process under hundreds of tons of pressure to the final finish grinding . . . every step is motivated by a single purpose, to provide in Grizzly Brake Lining the "finest product of the brake lining industry!"

"Bear in Mind"

Read how it's done in "Building UP to A Name," a free book for engineering and production executives. Write Grizzly Manufacturing Company, Paulding, Ohio.

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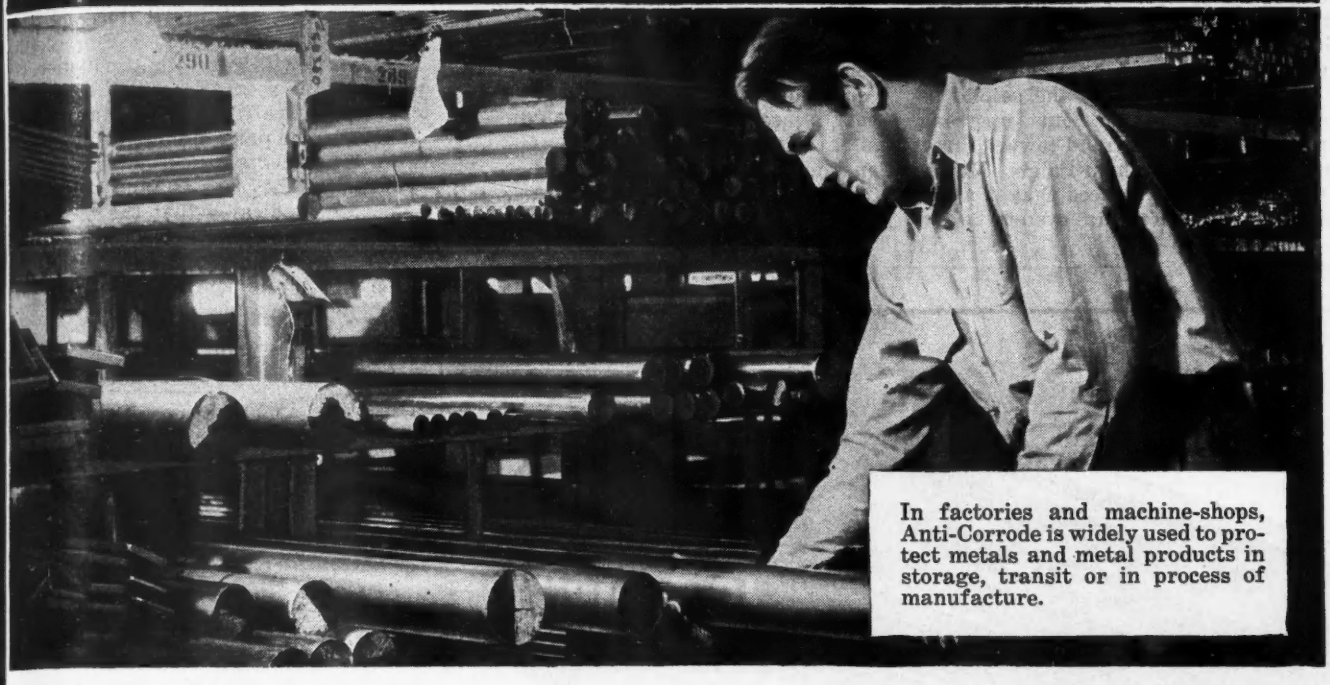
STOP RUST *this New, Efficient Way—*



In factories and machine-shops, Anti-Corrode is widely used to protect metals and metal products in storage, transit or in process of manufacture.

Anti-Corrode film protects your metal parts and equipment ... prevents corrosion and rust formations

Anti-Corrode #100 is one of several new types of Cities Service protective coatings for metals. Designed to prevent corrosion of raw stocks, finished parts and completed machines—either in storage or in active service—Anti-Corrode adheres firmly to metal surfaces, displaces moisture and protects longer than similar materials now on the market.

Cities Service Anti-Corrode #100 may be applied by ordinary work-shop methods—spraying, dipping, brushing or rolling. Independent of metal quality, finish and irregularity of surface, the protective film is continuous and non-porous—does not break at sharp edges nor rupture on flat surfaces.

Cities Service Anti-Corrode #100 serves as a lubricant as well as a rust preventive and need not be removed from metal to be stamped, drawn, or otherwise formed. It can be removed simply with kerosene or any petroleum solvent.

ANTI-CORRODE Gives You 10 BIG ADVANTAGES

1. Adheres to all metal surfaces.
2. Impervious to humid atmospheres.
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5. Chemically inert to ferrous and non-ferrous metals.
6. Inhibits *"under"* rusting.
7. Easy to apply—easy to remove.
8. Lubricates as it conserves.
9. Will not become brittle.
10. Protects metals in service or storage.

Whether your problem is to protect a single valuable tool or a million dollars worth of metal or equipment, write now for a *free* demonstration of Anti-Corrode. Mail the coupon today.

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Gentlemen: Please contact me for a FREE demonstration of Anti-Corrode in our plant. (This offer limited to industrial users in Cities Service marketing areas East of the Rockies.)

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Hudson Doubles Number Of Distributors

Instead of reducing or eliminating distributors in its sales setup, Hudson Motor Car Co. has expanded its number of distributorships to double what it was before the war, according to George H. Pratt, general sales manager.

Hudson thus becomes the second independent to strike out upstream against the current trend toward direct memberships. Graham-Paige Motors Corp. recently announced that it would use the distributorship system in organizing its postwar sales organization. Both companies state they believe the system is inherently satisfactory, and Pratt states it will be retained until it no longer does the job.

Other points included by Pratt in the Hudson postwar sales program include: A policy of competitive discounts, with no reduction contemplated; continuance with minor changes, of the continuous selling agreement which has been in use about 10 years; distribution of first postwar cars to distributors and dealers on a percentage basis determined after an analysis of the territory and consultation with retailers, and new stress on a parts merchandising program.

The postwar sales organization will consist of six divisions with jurisdiction over 16 regions. Sales division personnel will include a manager, business management, advertising and personnel heads, and distributor and zone organization men.

Hudson will get into production of new cars as soon as most others in the industry, Pratt stated, pointing out that the company builds many of its own components, such as bodies, engines, clutches, axles and transmissions. He indicated that the first postwar models would embody improved styling over 1942 models with considerable improvement in fittings and upholstery.

—make 120,000 of the most accurate* Tools in the World!

(at a cost of about 2⅓ mills per tool)

With the popular No. 1 Set of 81 blocks, as illustrated, any one of 120,000 different size gages may be made up (in a few moments), in steps of .0001" from minimum size .200" to more than 12 inches.

On a strict cost basis, it is thoroughly practical to extend the benefits of Jo-Block precision well beyond your master-gage department and your tool-room, to include inspection of close-limits production as well. This is particularly true of those limited-quantity jobs which might be described as "custom-production," for which permanent gaging could easily cost more than the job itself. The cost of replacing any blocks that might be thus unduly worn would be negligible by comparison.

Anyone who must measure precisely and easily and quickly, can *and will* do a better job if he has ready access to a set of Jo-Blocks. Write for Catalog 16 to FORD MOTOR COMPANY, Johansson Division, Dept. AA, Dearborn, Michigan.

*Currently manufactured to accuracy standards of ±.000004 and .000008 of an inch

Ford Johansson GAGE BLOCKS

AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the April 1 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES went to press:

ANDOVER-KENT AVIATION CORP., Andover Motors Corp., Elmira, N. Y.

BOSTON WIRE STITCHER CO., East Greenwich Plant, East Greenwich, R. I.

COVERED WAGON CO., Mount Clemens, Mich.

ELECTRO METALLURGICAL CO., Ashtabula Plant, Ashtabula, Ohio.

FORD MOTOR CO., Twin City Branch, St. Paul, Minn.

GENERAL ELECTRIC CO., Fort Edwards Plant, Fort Edwards, N. Y.

THE GENERAL TIRE & RUBBER CO., Tire Producing Plant, Akron, Ohio.

KINGSBURY MACHINE TOOL CO., Keene, N. H.

MASSEY-HARRIS CO., Tank Plant, Racine, Wis.

SIGHT FEED GENERATOR CO., West Alexandria, Ohio.

★ "E" Star Awards ★

for continuous meritorious services on the production front have been awarded to the following firms:

AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind.

BORG-WARNER CORP., Spring Division, Bellwood, Ill.

BURGESS-NORTON MANUFACTURING CO., Geneva, Ill.

DE VILBISS CO., Toledo, Ohio.

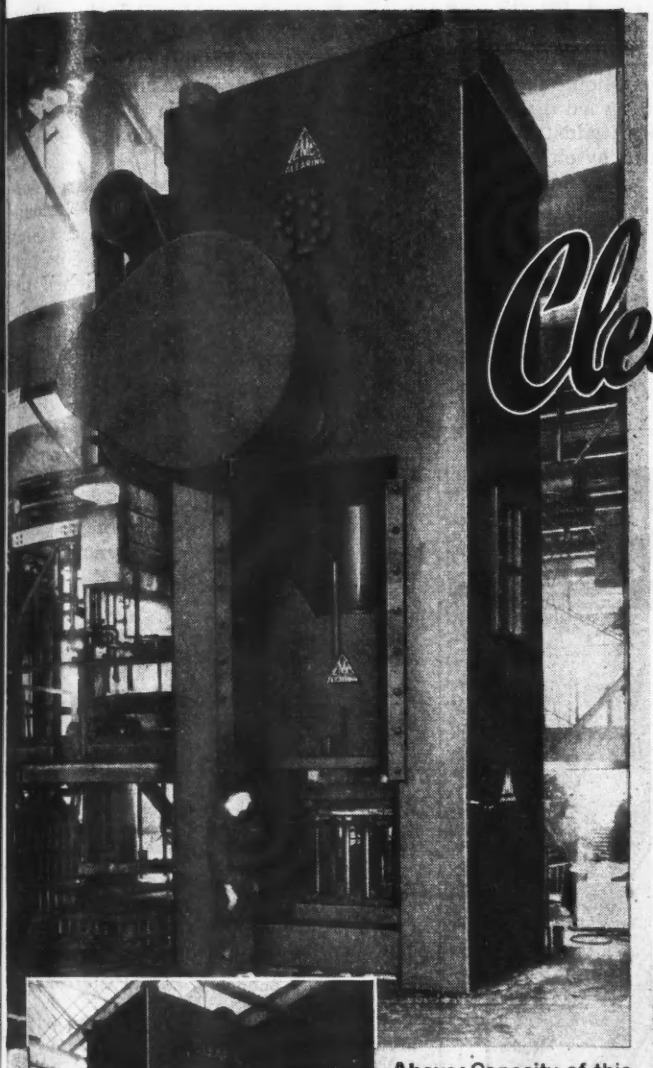
GRAY MARINE MOTOR CO., Detroit, Mich.

HELLER BROTHERS CO., Newcomerstown, Ohio.

LODGE & SHIPLEY MACHINE TOOL CO., Plant One, Cincinnati, Ohio.

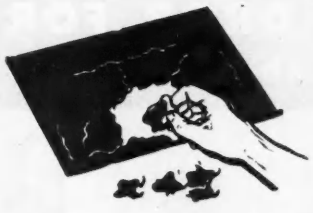
LODGE & SHIPLEY MACHINE TOOL CO., Plant Two, Cincinnati, Ohio.

WALES-STRIPPIT CORP., North Tonawanda, N. Y.



Clearing Presses

FIT INTO THE PICTURE



The Clearing Presses shown here were able to fill the gaps in production lines because Clearing makes doubly sure that each press fits the job. Hundreds of other installations of Clearing presses on vital jobs have been made for the same important reason.

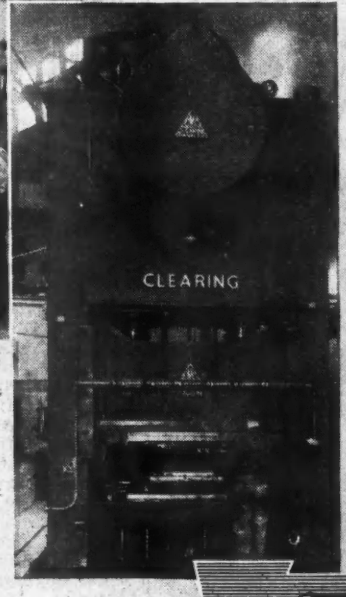
Instead of asking you to settle for a stock model press only with the capacity you require, Clearing asks these two questions. What operation do you want the press to perform? What rate of production do you require? Then from all possible ways of supplying your need, Clearing engineers choose the one way that will do your job best on both counts. The skill and experience Clearing has gained on so many heretofore "impossible" press-building jobs make that press almost invariably one with shorter work cycles, producing fewer rejects with reduced inspection time and easier to operate.

Get the advantages of presses that fit into your picture . . . consult Clearing now concerning your immediate or future needs.

CLEARING MACHINE CORPORATION
6499 West 65th Street ★ Chicago 38, Illinois

Above: Capacity of this Clearing Single Action Mechanical Press is 1,000 tons. It has a 60" x 62" bed area and operates at 18 strokes per minute.

Above: Having a bed area of 30" x 36" and a 150 ton capacity, this Clearing Single Action press delivers 35 strokes per minute.



Right: With a 12" stroke and 600 ton capacity, this Clearing press makes 10 strokes per minute.

ARMY E NAVY

MECHANICAL AND HYDRAULIC PRESSES
FOR SUCH OPERATIONS AS DRAWING
★ BLANKING ★ FORMING ★ FORGING

CLEARING ★

Plan for Disposal of Surplus Cutting Tools

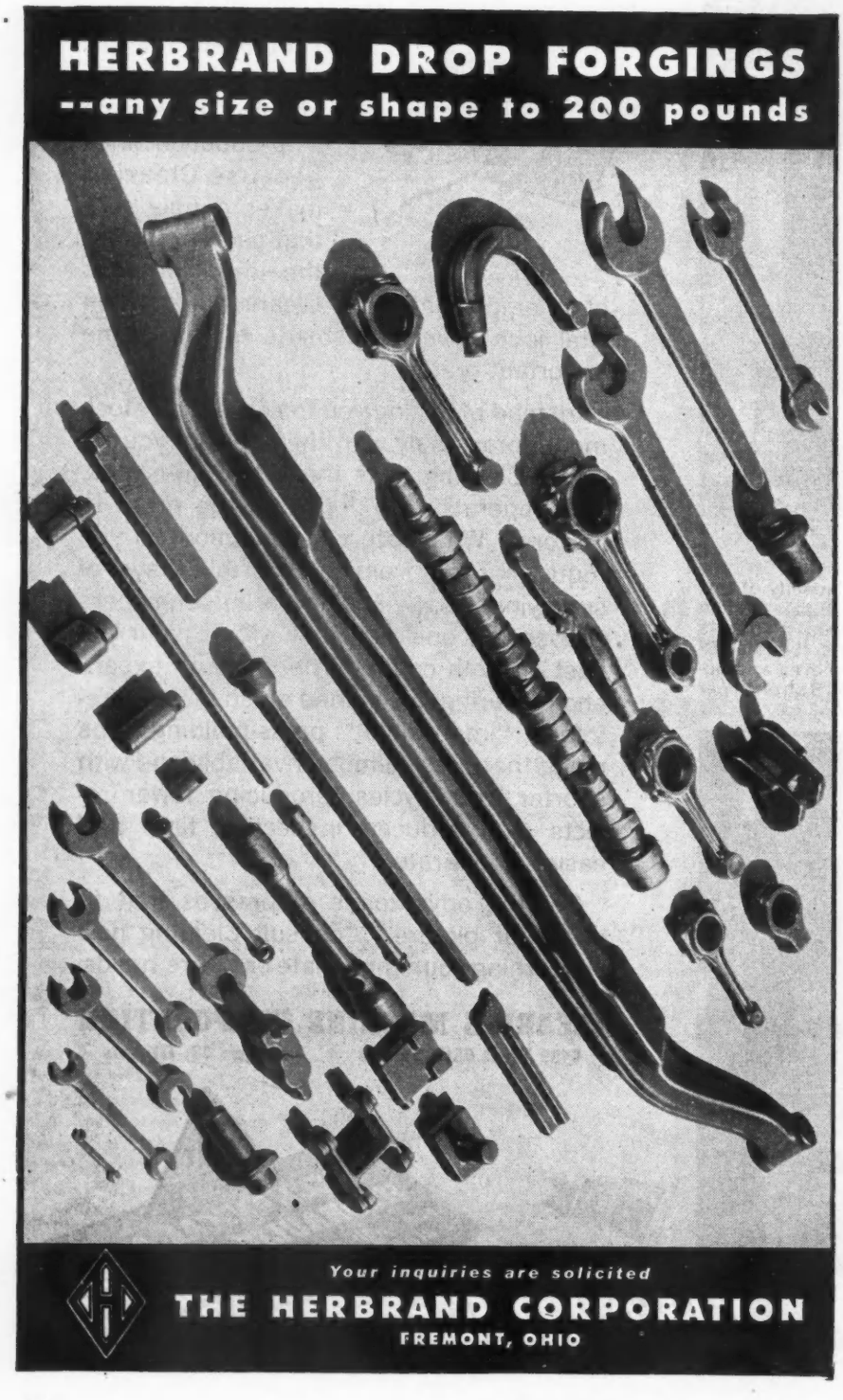
The Surplus Property Board has announced a plan for disposing of surplus cutting tools owned by the government through the original manufacturers. The plan may set the pattern for similar disposal of government-owned machine tools.

Under the plan, DPC would contract with 235 cutting tool manufacturers to have all cutting tools originally sold by them returned, and would reimburse them for handling, reworking, reconditioning and storing. The manufacturer would fill 25 per cent of his orders from the government surplus and would receive a 17½ per cent selling commission. Thus, the surplus would be absorbed gradually without disrupting the industry. Contracts could be canceled by either party by filing a 10-day written notice.

Surplus Planes Offered At Fixed Prices

Surplus primary trainers are now being sold at fixed prices, each plane with a price tag. Previously these models were sold on a competitive bid basis. Beginning on April 6, three thousand planes, Fairchilds, Ryans, Boeings and other primary trainers, formerly used to train Army and Navy pilots, were offered for public sale at 53 RFC sales centers throughout the country.

These planes have been declared surplus by the armed services because they are no longer needed in training pilots. They had been used for that purpose earlier in the war when the military air forces were being rapidly built up and pilot training was at its height. Personnel requirements of the Air Forces have now been met except for the necessary training of replacements. The RFC, a disposal agency designated by the Surplus Property Board, will market them on a price-tag basis at prices ranging from $875 to $2,400 for individual planes whose original cost to the government approximated $9,000 each.



PERSONALS

Recent Appointments among Automotive and Aviation Manufacturers:

Ford Motor Co., **William S. James**, Director of Automotive Research.

Adel Precision Products Corp., **Melvin H. Hass**, Adm. Asst. to President.

Graham - Paige Motors Corp., **Walter Beinecke**, elected a director.

Dodge Bros. Corp., Div. Chrysler Corp., **L. J. Purdy**, elected director and vice-president in charge of trucks.

Cadillac Motor Car Div., G. M. Corp., **Charles W. Schooley**, Asst. Merchandising Mgr.

Mack Trucks, Inc., **C. F. Larsen**, Service Mgr., General Service Dept.

McQuay-Norris Mfg. Co., **Arthur G. Drefs** elected president, **W. K. Norris**, chairman of board.

United States Rubber Co., **Luther B. Martin**, director of tire development and research. **Dr. Arthur W. Bull**, associate director tire development, with headquarters in Detroit, **W. E. Clark**, Asst. Gen. Mgr., Textile Div.

Consolidated Vultee Aircraft Corp., **W. R. Lawrence, Jr.**, mgr. of Nashville Div.

Bendix Helicopter, Inc., **Claire L. Barnes**, chairman of board of directors.

Packard Motor Car Co., **Frank Link** and **Louis H. Rowe** to business management staff.

Bell Aircraft Corp., **D. Roy Schoults**, vice-president of sales.

Chevrolet Motor Div., G. M. Corp., **D. J. Guggenheim**, asst. to divisional comptroller, Central Office; **K. H. Kiesner**, comptroller at Muncie; **R. L. Ahern**, comptroller, Oakland, and **Edmund W. Daley**, comptroller at St. Louis.

Curtiss-Wright Corp., **John M. Martin**, Mgr. of Div. Subcontracting.

Ford Motor Co., **William C. Boulcott**, Manager, Omaha Branch; **Earl T. Zweifel** and **E. H. Reuss**, Asst. Branch Mgrs., Chicago and Milwaukee.

Bendix Aviation Corp., **Raymond P. Lansing**, director.

The Firestone Tire & Rubber Co., **C. S. Gischel**, Mgr. newly created aircraft tire and accessory sales dept.

Republic Aviation Corp., **Arthur A. Pieper**, financial vice-president.

Penna. Salt Mfg. Co., **A. S. Woodard**, asst. chief engineer; **J. J. Duffy, Jr.**, asst. mgr. sales.

Purolator Products, Inc., **Frank P. Herman**, executive vice-president.

War Production Board, **Henry P. Nelson**, director of Aircraft Div.

in your Production is MACHINABILITY

• Take the case of the two large steel parts on the opposite page. Specifications called for production by forging or casting. But facilities were not available and delivery was urgent—so they were *machined* from cold drawn bars.

Look at the very small parts in the circle. They had to be made on a mass production basis—with costs held down.

Suppose these were your problems. No, they're not difficult—but the vital factor in their production, as in millions of steel parts turned out every year, is MACHINABILITY.

There's no side-stepping this proved fact: The ability of the steel bars you use to take forming, milling, drilling, reaming, threading, tapping and similar operations at high speed and with heavy feed—with a minimum of tool wear—determines the profit you can make in steel parts production.

That's why Republic's Union Drawn Steel Division places MACHINABILITY above all other qualities in cold drawn bars.

Year after year for more than half a century, Union Drawn metallurgists and engineers have spent long hours in the laboratory and in parts producers' plants. They've cut up tons of steel on an automatic screw machine to learn the intricacies of machinability.

And from this research they've been able to steadily increase the machinability of Republic Union Cold Drawn Steels to its present high efficiency—to reduce tool-wearing abrasives to a remarkably low point—and to improve the machined surface.

To further improve machinability, and to assure uniform hardness and physical properties, Union Drawn has greatly increased capacity in all plants for furnace treated cold drawn steels—annealed, normalized, spheroidized, stress relieved and otherwise heat treated.

If the vital factor in your production is MACHINABILITY, Republic Union Cold Drawn Steels can provide it, *as always,* in the high degree for which they have become famous. And Republic metallurgists are ready to help you get best results from these steels.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic

UNION COLD DRAWN STEELS

PUBLICATIONS

Westinghouse Electric & Mfg. Co. has announced the publication of a new **Steam Power Planning Guide.** Part one of the 40-page booklet illustrates types of turbines, and charts turbine sizes and speeds. Part two on Performance Data covers basic operating conditions, including effect of deviation in pressures and temperatures on heat rates, regenerative feed-water heating; recommended condenser sizes and condenser dimensions; condenser friction, impeller, propeller and axial type circulating pumps, and condensate pumps.*

Westinghouse NEWSFRONT, a new monthly publication issued by Westinghouse Electric & Mfg. Co., begins with the April number. It is illustrated with drawings and photographs, contains short articles describing the latest achievements by the company in the fields of scientific research, engineering and production. For inclusion on regular mailing list, write Editor, Westinghouse Newsfront, 306 Fourth Ave., Box 1017, Pittsburgh, Pa.

A new catalog of **aircraft tools** has been issued by Zephyr Mfg. Co. It lists and pictures precision tools for the aircraft and other manufacturing trades. Shown in the catalog are actual-size photographs of tools in actual use. The line includes angle drills, drill adaptors, micrometer stop countersinks, countersink cutters and pilots, back spotfacers, etc.*

Arrived O.K. is the title of a new booklet published by Minnesota Mining and Mfg. Co. It contains detailed information on adhesives made to meet government specifications, has actual photographs to illustrate step-by-step operations involved in sealing fibreboard and V-board shipping containers and waterproof case liners for export shipment.*

A booklet, **DC Varnishes,** describing the properties of DC 993 Varnish, has been published by Dow Corning Corp. Recommended procedures in applying Dow Corning Silicone to the insulation of electrical equipment is including in the booklet.*

Bulletin No. 807, issued by the United States Dept. of Labor, and titled **Improvement of Labor-Utilization Procedures,** is available through the Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C. Single copies are 10¢.

The Celanese Plastics Corp., Div. of Celanese Corp. of America, has announced the publication of a book entitled **Fabricating Methods for Lumarith*, Celluloid* and Similar Thermoplastic Materials.** Written in simple, direct language, comprehensively diagrammed and illustrated, the manual contains complete information on the fabricating of thermoplastics, including primary and secondary cutting procedures; the fabricating of film, foil and sheet stock; the various molding processes and methods for finishing all types of articles made from these materials. Copies are $1.00 each and may be obtained by writing the Celanese Plastics Corp., 180 Madison Avenue, New York 16. (*Reg. U. S. Pat. Off.)

The Automatic Transportation Co., Div. of The Yale & Towne Mfg. Co., has published a new 4-page condensed catalog folder. It consists of detailed specifications covering the **Transporter,** battery powered, hand lift truck and **Automatic Electric Industrial Power** lift trucks*

A 20-page booklet on **right angle reduction gearing** has been issued by Cone-Drive Div., Michigan Tool Co. Entitled **Post-Gradute Course for Gears,** Bulletin No. 745, it records some of the current wartime uses of Cone-Drive gearing to indicate the type of service for which this gearing has proven itself ideally adapted.*

100 Years of Air Control is the title of an interesting booklet published to commemorate the establishment and subsequent progress of A. Schrader's Son in the manufacture of pneumatic valves and allied air control products.*

Bulletin M-100-145, which tells about the quick and accurate grinding of threads and forms with the **Multi-Form Wheel** on Sheffield Precision Thread and Form Grinders, has been issued by Sheffield Corporation.*

A new bulletin, describing **Roto-Finish,** mechanical process for de-burring and finishing metal parts, has been released by The Sturgis Products Co.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

GRAY-MILLS SUPERFLO CENTRIFUGAL PUMPS

FOR COOLANTS

CUTTING OILS

LUBRICANTS

MORE VOLUME PER HORSEPOWER

Here's a new line of centrifugal pumps that deliver *more volume per horsepower.* They are sturdy, dependable, compact, easy to install. Gray-Mills Superflo Pumps are economical to use, because they conserve power and operate with less maintenance. The flow can be regulated from a drip to a full stream without overloading the motor. Their advanced integrated design is an outward indication of built-in efficiency. Available with 1/25—⅛—¼ and ½ H. P. motors, in capacities from 9 to 75 gallons per minute. There are models with floating impellers and special abrasion repulsion fans for fluids with high abrasive content. Replace your obsolete, worn pumps with new Gray-Mills' for greater efficiency. *Prompt deliveries. Write for Bulletin.*

GRAY-MILLS CO., 1929 Ridge Ave., Evanston, Illinois

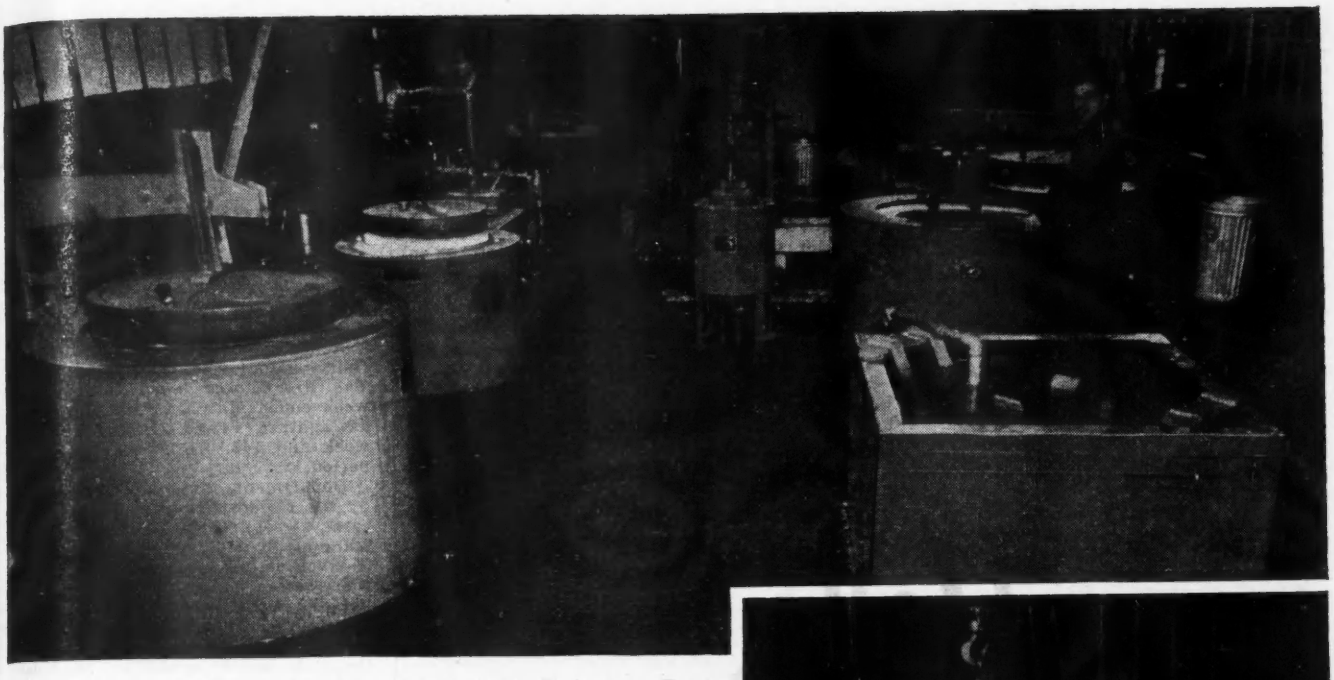
GRAY-MILLS

SUPERFLO CENTRIFUGAL PUMPS

PORTABLE COOLANT SYSTEMS, PORTABLE PUMPING UNITS, INDUSTRIAL FLUID REFRIGERATION, PARTS CLEANING SYSTEMS

Kenneth Campbell Awarded Wright Brothers Medal

Kenneth Campbell, senior project engineer of Wright Aeronautical Corp., Paterson, N. J., was awarded the Wright Brothers Medal by the Society of Automotive Engineers. The medal, presented at the Aeronautical Meeting of SAE Metropolitan Section in New York, recognized as the best paper on aerodynamics delivered before an SAE meeting in 1944 Mr. Campbell's technical treatise, "Engine Cooling Fan Theory and Practice." In his paper, Mr. Campbell described engine cooling fans as aerodynamic assets contributing greatly to airplane performance, and explained how the fan must be adapted to engine needs for best results.



General view of heat-treat department, Tube-Reducing Corp., Wallington, N. J. A Rockrite die, used in cold-reduction of the company's "Rockrite" tubing, is being lowered into one of the four big Vapocarb-Hump hardening furnaces.

Heavy Production of

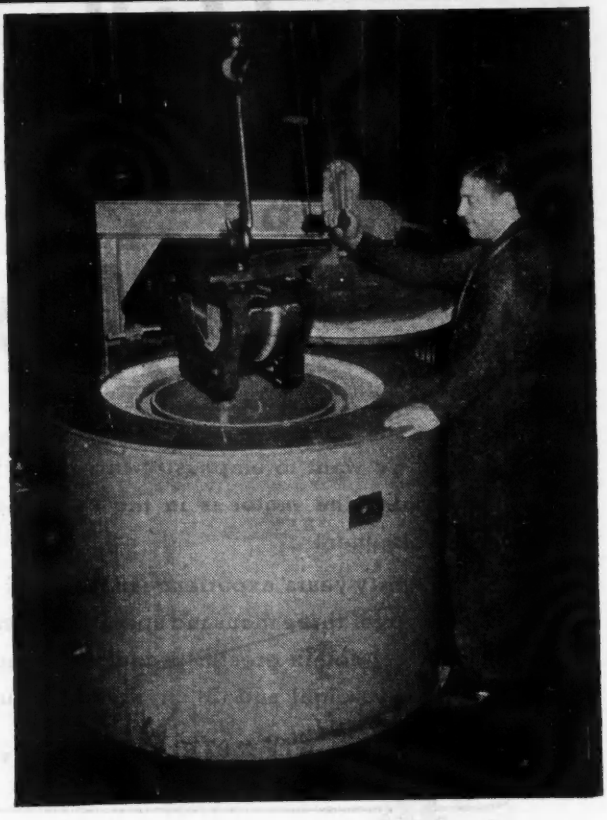
DIES AND MANDRELS

Uses VAPOCARB-HUMP Hardening

Heat-treatment of tube-reducing dies and mandrels is in many ways a production job, rather than a series of tool-room problems, in Tube-Reducing Corp.'s plant. Jigs and fixtures standardize the placing and handling of the large numbers of tools in the furnaces and quench. Records of performance are guides in maintaining standard procedures, and, wherever possible, all controls are automatic.

A central factor in securing uniformity plus automatic control is use of the Vapocarb-Hump Method for hardening. Four large Vapocarb-Hump furnaces assure the same protective atmosphere for all dies and mandrels, so that pitting and scaling are equally prevented. The Micromax recording controllers, each with its two sensitive, carefully-placed thermocouples, show temperatures of both dies and furnace walls and enable heating to be held to any desired rate or soak point. Micromax records are easy to inter-compare, and results obtained in one furnace can be duplicated in any other.

Our compact, well-illustrated Catalog T-621 gives a complete words-and-pictures description of the Vapocarb-Hump equipment and the results it is helping users secure. A copy is free on request.



Close-up of operation shown at top of page; Rockrite die, made of SAE52100 chromium steel, is cradled in special furnace fixture; and will be lowered into Vapocarb-Hump furnace for automatically-controlled heating, at specified rate, in Vapocarb protective atmosphere. Quenched on a falling temperature, it will have a Rockwell "C" hardness of 60 to 62, with uniformly smooth surface.

Jrl Ad T-621(33)

depends on me!
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

GM Ready to Begin Production in Australia

General Motors Holdens, Ltd., G.M. overseas subsidiary, has notified the Australian government that it is ready to start immediate production of motor vehicles, including chassis and engines. The Australian government, in turn, has informed the company that it will not undertake manufacture of cars if G.M. Holdens gets in production of cars in a reasonable time. The subsidiary will obtain from the parent corporation various manufacturing rights, services of engineering specialists, and access to G.M. factories in U. S., Canada, and England. Proposed models are a five passenger sedan and a utility car designed especially for Australian conditions.

Kaiser Wins Court Decision

Under a decree granted in Federal Court in Detroit, Henry J. Kaiser, West Coast shipbuilder, has won exclusive rights to patent applications for the Kaiser postwar automobile and the "Jeep Junior." The decree restrains Karl K. Probst, Detroit engineer and designer, from assigning rights to the designs or inventions related to the car or divulging information regarding them. Kaiser contended that he had hired Probst and another engineer to develop the cars and that he had paid the patent fees.

Are You
DEVELOPING A PRODUCT THAT REQUIRES A...
Motor?
If so we want to emphasize this fact: the best time to consider the motor is in the *early* stages of product development.
Our thirty years' experience in the small motor field covering over three thousand special applications, may help you—(1) obtain greater product compactness (2) lower product weight and (3) improved product performance.
THE LAMB ELECTRIC COMPANY • KENT, OHIO
THOROUGH ENGINEERING is the basic factor behind the successful operation of this Feathering Pump motor and many other special application motors we have designed for all types of equipment.
Lamb Electric
FORMERLY Black & Decker Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Renewed expansion of business activity is indicated by current reports. *The New York Times* index for the week ended March 24 stands at 143.6, as against 142.8 for the preceding week and 143.2 for the corresponding period last year.

Department store sales as reported by the Federal Reserve Board for the same week continued to increase, standing at 226 per cent of the 1935-39 average, as compared with 214 the week before and 182 a year ago. Comparisons with last year's corresponding figures show gains of 24 per cent for the week ended March 24 and for the four weeks ended on that date, and a rise of 18 per cent for 1945 thus far.

Electric power production in the week ended March 24 was slightly larger than in the preceding week but 0.2 per cent less than in the comparable period last year, as against a similar decline of 0.1 per cent a week earlier.

Railway freight loadings in the same period totaled 816,058 cars, 269 above the figure for the week before and 38,480 cars more than the comparable number a year ago.

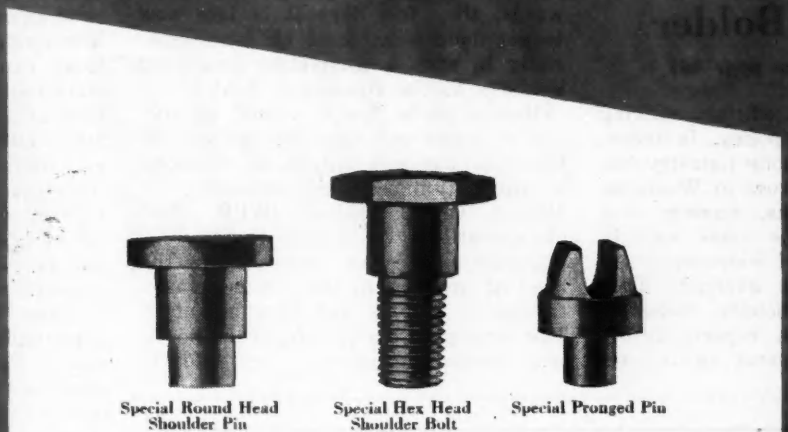
Crude oil production for the week ended March 24 averaged 4,782,115 barrels daily, which is 8200 barrels above the figure for the preceding week.

Production of soft coal in the week ended March 17 is estimated at 11,825,000 net tons, as against 10,885,000 tons a week earlier and 12,070,000 tons a year ago. Output for the year to date totals 127,435,000 tons, as compared with 139,337,000 tons for the corresponding 1944 period.

Engineering construction contracts awarded during the week ended March 29, according to *Engineering News-Record*, totaled $37,301,000, which is 58 per cent above the figure for the preceding week, 4 per cent above the average for the four weeks preceding and 27 per cent above the total for the corresponding week last year. For 1945 to date, however, the contract total is 16 per cent below the comparable sum last year.

In continued recession during the week ended March 30, the Irving Fisher index of wholesale commodity prices stood on that date at 114.56 per cent of the 1926 average, as against 114.65 a week earlier and the peak figure of 115.06 recorded on March 2.

Member bank reserves declined $274,000,000 during the week ended March 28, reflecting a decrease of $99,000,000 in total Reserve Bank credit, an increase of $214,000,000 in Treasury deposits with the Reserve banks and other changes. Excess reserves were estimated at $900,000,000, as compared with $1,100,000,000 a week earlier. During the preceding week, earning assets of reporting member banks declined for the ninth consecutive weekly period, with a decrease of $31,000,000 in commercial, industrial and agricultural loans.



Upsetting AUTOMOTIVE PARTS

SPEEDS PRODUCTION

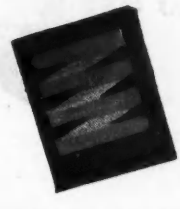
CUTS COSTS

Here are three special parts used in large quantities (two of them run into millions) by a large manufacturer of automotive equipment. They have both war and peacetime application.

They were originally made milled from bar. When sufficient production could not be obtained by that method, the problem was put up to *National*. We developed an upsetting procedure that met the need for *volume production* and also resulted in substantial *cost reductions*.

You may want to look into the possibilities of saving time and money on fasteners, for present needs or future. Or you may have a problem of fastener improvement on which our engineers can help you as they have many other manufacturers.

Chances are you'll be surprised at what can be done.



Send for a copy of this case history booklet describing briefly, with diagrams, 15 typical instances of time, materials and money saved. Ask for the "Savings" booklet.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

Talk of Reconversion Becomes Bolder

(*Continued from page* 46)

tary and government officials, making it more or less official policy. It underlines what the automobile industry has been trying to get across in Washington for several weeks, namely that definite plans must be made well in advance of V-E day if widespread unemployment is to be averted. That this is recognized officially, however, is only a start. The report, unfortunately, is very general in nature, and acording to some observers, comes at 11:59 on Saturday night. In other words, they feel that it is late now to get done what must be done, especially in such a completely scrambled industry as the automotive field.

Despite calls for increased production of munitions, there are indications that the national output is crowding a production ceiling, according to Hiland G. Batcheller, WPB chief of operations. Although there is a possibility of some increase in the level of production, there is no reason to expect that it will be substantial. The principal reasons for this lie in important decisions made in the early days of the war. Faced with the choice of taking immediate steps to increase production of end products or first developing expanded production of basic raw materials, government officials took the only possible course in view of the desperate military urgency and limited the expansion of raw material resources whenever such expansion interfered with the production of finished munitions. That policy has paid off in large volume of fighting goods but has admittedly put a ceiling on present munitions expansion. Another limiting factor is the drain on war supporting activities imposed by diversion of resources to production of war goods and the cuts in supplies. WPB now is conscious that any further squeezing of the civilian economy probably would result in decreasing, rather than boosting, war output. The recognition of this fact undoubtedly will be an important factor to be considered in determining the extent of reconversion that will be allowed after the fall of Germany.

The Truck Trailer Manufacturers Industry Advisory committee has recommended to WPB that the 1945 commercial truck trailer program be revised upward from 19,304 units to 26,000 in order to meet requirements for hauling essential war freight. Greatest increase asked for is the general freight type trailer, with a suggested step-up to 21,000 units from the present authorization of 15,800.

Packard Motor Car Co. is planning to include reseach in gas turbines and jet propulsion engines in its advanced aircraft engine development program undertaken at the request of the Army Air Forces Technical Service Command. Arthur Nutt, director of the aircraft engineering division of the company, recently announced the scope of the project, which is to be carried out with facilities now nearing completion at the Toledo division and the Willow Run Army Air base. He stated that new developments such as the gas turbine for aircraft and private flying on a large scale as a means of transportation will not come as a revolution, but will come through a process of evolution, which at present is being accelerated by war.

NITE HAWK

AERO-STARTER

QUICKLY STARTS BOMBERS, CARGO and FIGHTER PLANES

No need now to burn up starting batteries and generator sets. Portable, engine-driven, the NITE-HAWK provides quick, sure starting in any weather—produces 500 amperes of electric power at either 12 or 24 volts. Same power is used to test landing gear, circuits, turrets, etc. Equipped with floodlights for night operations. Air compressor attachment available.

Write for Bulletin NH12A.

NITE HAWK

Lister-Blackstone

INCORPORATED 1706 SO. 68TH ST., MILWAUKEE 14, WIS.

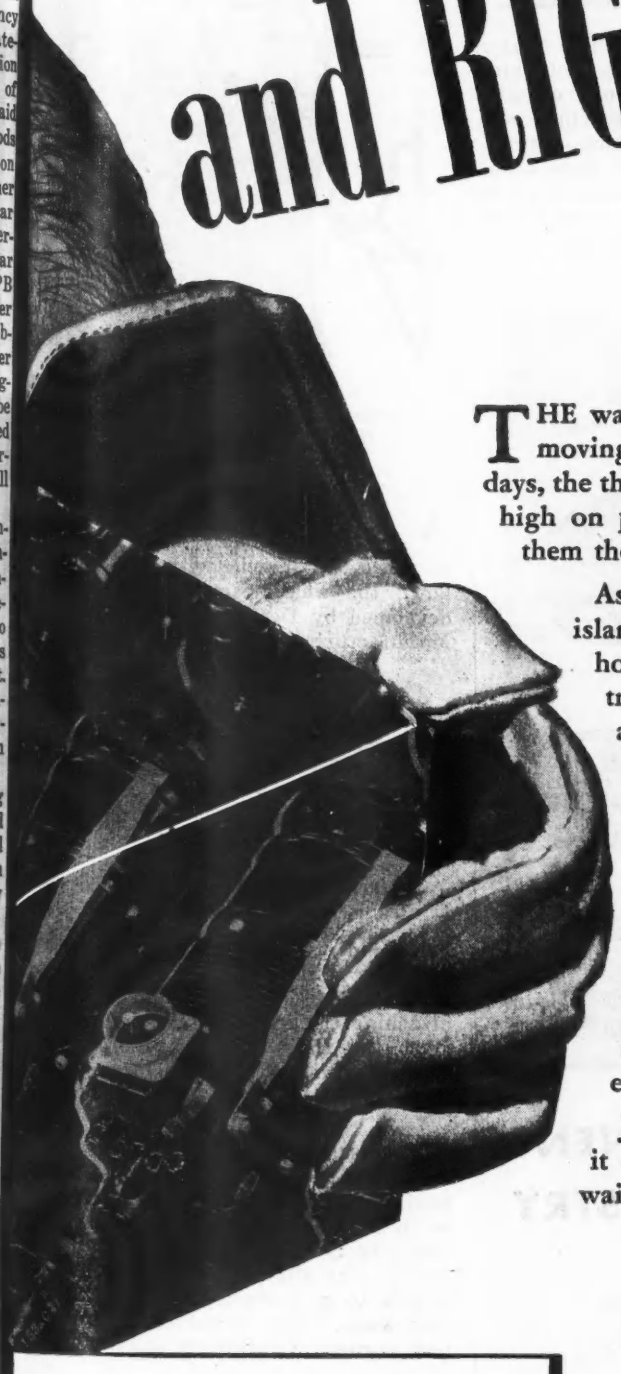
MFRS. OF PORTABLE NITE-HAWK AERO-STARTERS, SEARCHLIGHT AND FLOODLIGHT UNITS

ALSO DIESEL ENGINES AND DIESEL-ELECTRIC POWER PLANTS

United Aircraft Corp. Develops New Projects

Development and utilization of several new and radical aircraft projects by United Aircraft Corporation were outlined for the first time in the annual report to stockholders. The projects include gas turbine and jet propulsion engines, an entirely new type of Navy fighter plane, a new and improved propeller suitable for use with gas turbine engines, a new 3,000-hp radial air-cooled engine, and further indications of the adaptability of the helicopter for postwar use in commercial air transport.

and RIGHT!



THE war wouldn't wait—it has never waited—and today it's moving faster than ever. That's why, in the earliest, darkest days, the thousands of Americans at Jack & Heintz set their sights high on production of vital aircraft equipment—and will keep them there to the very end!

As the fighting turned slowly in our favor and now . . . island by island . . . mile by mile . . . draws closer to the enemy homelands, the tempo goes up and up and up. Doubled, trebled, quadrupled production assignments roll in . . . and the equipment rolls out at the same pace. Laboratory-precision products never before turned out in more than a few score are streaming to all fronts by the tens of thousands.

As a result of this intensive manufacturing experience, Jack & Heintz is today a group of several thousand time-conscious, production-minded people who have packed years of experience and know-how into months—broken all records in mass production of precision equipment—and kept faith with or beaten every deadline ever given them.

Just as this organization has kept pace with war, so it can help you in peace. For postwar competition won't wait, either—and the manufacturer who gets to market with *enough . . . on time . . . and right* will head the field.

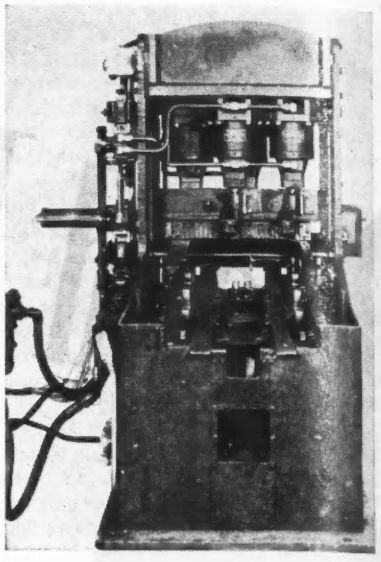
JAHCo

JACK & HEINTZ
Incorporated

Jack & Heintz Inc., Cleveland, Ohio, manufacturers of aircraft engine starters, generators, gyro pilots, gyro flight instruments, magnetos, motors.

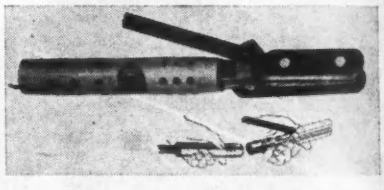
New Production Equipment

A SPECIFIC purpose machine for pressing and staking the wedge pin in place on the T-66 track shoe, was recently completed by Hydraulic Machinery, Inc., Dearborn, Mich. The machine is hydraulically operated throughout, with cycle arranged for automatic or semi-automatic control. After shoes are assembled in sections of ten, they enter the part of the machine where the pins are manually inserted, with the section taking its normal contour on the machine bed. The machine performs the operations of pressing the pins into place and staking them automatically. An index mechanism moves a complete section forward to the next shoe and the cycle is repeated.



Special purpose machine built by Hydraulic Machinery, Inc.

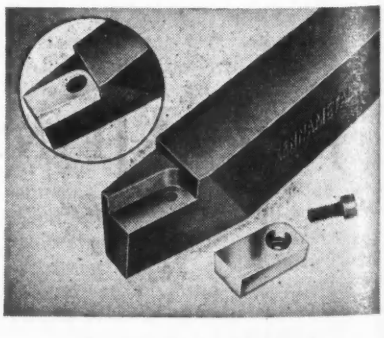
AN ELECTRODE holder designed so that the front assembly may be readily detached by hand, without shutting down the welding machine, has been developed by Detroit Electrode Holder Manufacturing Co., Detroit, Mich. The



Marine model electrode holder

holder, identified as the Marine model, is of the resilient-jaw type, fully insulated. It is said that removing or reattaching the front requires but 15 sec. With the front removed, there is no danger of arcing at the holder.

KENNAMETAL, INC., Latrobe, Pa., has developed a Kennametal tool blank having a drilled and counterbored hole to provide for attachment to steel shank by means of a recessed-head cap screw. The angularly-set screw serves merely to hold the tip against the recess walls, which resist the main cutting thrusts. (*Turn to page* 84, *please*)



Kennametal tool blank

STERLING ALUMINUM PERMANENT MOLD CASTINGS FOR ALL INDUSTRY

Sterling has for years produced fine pistons by using a unique and proven, patented molding process, fine quality materials, and unsurpassed skill in workmanship.

In addition to our piston factory, we are just completing a very modern foundry that will produce all types of aluminum permanent mold castings.

Our staff of engineers will be glad to assist you with your engineering problems. Their experience may be valuable to you.

STERLING ALUMINUM PRODUCTS Inc., St. Louis 6, Mo.

Automatic Mechanism of the Wickwire Propeller

(*Continued from page* 29)

The Wickwire Automatic propeller is an example of the second method of approach. It utilizes an extremely simple mechanical conception, sacrificing minor performance features to gain its basic simplicity. It overcomes the previously mentioned design difficulties of the automatic propellers by the following measures:

1) Providing the operating power directly from the engine torque at the propeller spline.
2) Employing a highly developed anti-friction bearing arrangement.
3) Various design refinements worked out during an ambitious program of development over a period of several years.

Operating principle of the Wickwire automatic is quite simple. With reference to Fig. 1 the propeller comprises a hollow coupling shaft (1), with engine torque transfer arm (2) floating in propeller hub (3) at journals (4). The propeller hub has two bearings (5), (5′), for mounting the blades (6), (6′). These blades are provided with engine torque acceptance levers (7), (7′). The latter connect with engine torque transfer arms by universal ball joints (8), (8′). Centrifugal controlling means consisting of counterweights (9), (9′) are designed to deliver a secondary centrifugal moment around the blade roots.

Because of direct engagement of torque transfer and torque acceptance arms (2) and (7), the engine torque is transferred, with a factor depending upon ratio of lever arm lengths, to the blade axes. The sense of this moment is such that the engine torque tends to *decrease* the pitch of the blades. The counterweights (9), (9′), are disposed upon the blades in such a way as to produce a substantial turning moment around the blade axes, tending to increase the pitch.

In operation both torques balance at the design RPM, producing design pitch of the blade at a set of standard design conditions. During the revving-up period of propeller operation, when centrifugal moment of the counterweights is still insufficient to produce proper blade pitch by balancing the fully developed allotment of engine torque, the blades lay against the low angle stops. As RPM rapidly pick up, the centrifugal moment about blade roots increases and eventually pushes the blades from the low pitch stops towards design pitch setting. Dynamic stability of the propeller system is assured by an ingeniously constructed damper wholly confined within the hub.

When equilibrium is established, the RPM remain very closely constant at a given engine torque in the face of wide variations of aerodynamic loading conditions encountered in flight at various speeds and altitudes. This is due to the fact that aerodynamic conditions do not directly influence the blade equilibrium, which depends essentially upon two balance conditions: the balance of engine torque against propeller load troque, and blade engine transfer moment against counterweight plus blade mass centrifugal moment.

Indirectly, there is some influence exerted by the aerodynamic loading conditions upon moment equilibrium around the blade axis, by virtue of a variation of the centrifugal moment magnitude produced by counterweights at any given constant RPM as a function of blade counterweight inclination. This variation can be, however, chosen quite small for a considerable variation in angle of blade setting, resulting in an insignificant change in RPM at constant engine power.

Steady State Theory of the Wickwire Automatic propeller

In a steady state of rotation, engine

(*Turn to page* 68, *please*)

NOPAK HY-PRESSURE Balanced Hydraulic Operating Valve, available in 4 sizes, either by-pass or accumular.

Making Good-

on High Pressure, High Speed Hydraulic Equipment

Only One **MOVING PART**

—the one-piece spindle of forged nickel alloy, heat-treated and hardened for long life.

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The NOPAK *Balanced* HY-PRESSURE Hydraulic Valve makes positive, accurate control of high-pressure oil-hydraulic* power a simple matter. It permits machine operators to work at top efficiency *all day*, without strain or fatigue. The net result is increased capacity and production for high-pressure hydraulic equipment.

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torque Q_m and propeller load torque Q balance, so that

$$Q_m + Q_p = 0 \quad (1)$$

Neglecting blade root bearing friction for the sake of simplicity there also must be equality of blade engine transfer moment M_b and centrifugal control torque M_c. Accoringly

$$M_b + M_c = 0 \quad (2)$$

For a two-bladed propeller, constructionally,

$$M_b = {}^1/_2 \epsilon Q_m \quad (3)$$

where ϵ is the lever arm ratio.

On the other hand, the centrifugal moment due to control counter weight and blade itself can be represented by the expression

$$M_c = k_c \operatorname{Sin} 2(\beta_1 - \beta_0)\ (\mathrm{RPM})^2 \quad (4)$$

k_c being a constant coefficient, β_1 blade inclination and β_0—blade and counterweight zero centrifugal moment angle. These are measured here between zero lift line and propeller plane of rotation. Angle β_0 is usually negative.

Finally, the load torque on the propeller can be approximated by the expression

$$Q_p = k_p \rho\ (\beta_1 - \gamma)\ (\mathrm{RPM})^2 \quad (5)$$

k_p being a blade geometry coefficient, ρ air density and γ the relative wind angle.

Solution of this set of equation is straightforward and yields the following expression for propeller RPM:

$$\mathrm{RPM} = \sqrt{\frac{{}^1/_2 \epsilon Q_m}{k_c \operatorname{Sin} 2(\beta_1 - \beta_0)}} \quad (6)$$

Here β_1 is blade pitch angle in the condition of equilibrium of all moments. It is determined by the transcendent equation

$$(\beta_1 - \gamma) = 2k_c/k_p \frac{1}{\epsilon \rho} \operatorname{Sin} 2(\beta_1 - \beta_0) \quad (7)$$

$(\beta_1 - \gamma)$ is, with our convention regarding angle reference, the no-lift line angle of attack of a representative blade element.

The Wickwire Automatic propeller can thus be classed as a load-independent RPM propeller, with constant speed of rotation at any given constant engine power output. Its RPM increase with engine power increase is practically independent of either forward speed of the plane or density of the surrounding air, within fairly wide limits. The current design of the Wickwire Automatic propeller, a products of the Wickwire-Spencer Aviation Corp., is shown in Figs. 2 and 3, depicting a general and a sectional view of the product. The propeller complies with existing standards, particularly with regard to mounting on various engines, and employs a large number of standard parts and fittings in its construction. The total number of parts, omitting repetitions and safety wire, is 78, of which 19 or 24 per cent are small standard AN fastenings. This compares favorably with present governor-controlled designs requiring a much larger number of parts.

Assembly and disassembly are quite straightforward and assure economical and easy maintenance and inspection. For servicing, only five special tools are required—three nut wrenches, snap ring pliers and a special snap ring for pulling the propeller off the shaft.

Permanent Molds for Aluminum Pistons

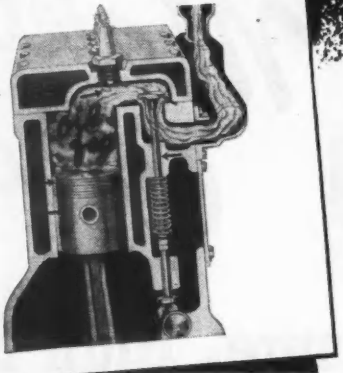
(*Continued from page 32*)

recognized sources. The material is received in the form of pigs and melted directly in the furnaces. No alloying or remelting is done here. Scrap and machine turnings are segregated, melted into pigs convenient for shipping, and returned to the suppliers for salvage and alloying.

For the molding operation, the operator cleans and prepares the mold, then pours a measured ladle of molten metal into the mold. It may be noted at this point that the design of the gating is another feature contributing to piston

(*Turn to page 70, please*)

advise motor users:



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there's NOTHING else like it!

No mechanical system has ever been invented that assures constant, adequate lubrication of valves, guides, upper cylinder, pistons, rings. That is why sticky valves, burned and pitted valve seats, worn rings, and carbon and gum accumulations in upper cylinder are usually the first symptoms of motor trouble. Lubri-Gas Laboratories have developed an exclusive method of chemically processing 40 SAE lubricating oil, so that it enters the combustion chamber, through the carburetor, as an oil fog, and coats all upper cylinder parts with a film of clean oil. The results of this better lubrication are more power, more mileage per gallon, more pep, less wear and repair, freedom from carbon and gum and prevention of overheating and oil pumping. Now when it is so important to keep equipment in operation and out of the repair shop, LUBRI-GAS is indeed a God-send!

Send for Free Lubri-Gas File. Contains complete information about this modern motor fuel treatment.

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Cleans and Lubricates as It Powers the Motor

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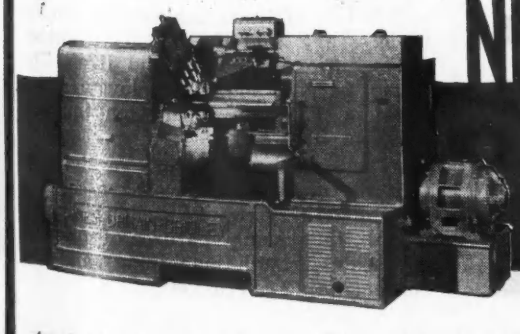
Poor equipment and too much of it will stop anybody's air force . . . failures that result in the loss of men and vital war materiél. Thanks to the unequaled performance of American Industry, we point with pride to the world's finest planes and the most versatile airmen . . . gaining air supremacy 'round the globe.

It takes tens of thousands of precision-built parts to put a plane in the air and a large number of the most vital ones are machined on New Britain multiple spindle chuckers and screw machines . . . automatics geared for large scale part production that meets rigid aircraft specifications for quality and quantity.

Many manufacturers will rely on these same methods in establishing a firm position in the competitive markets postwar . . . a time when speed, accuracy and price-per-piece will mean everything. Don't overlook the New Britain Sales-Engineer in developing your peacetime production plans . . . for he may be able to supply the answers automatically.



NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

quality. All molds are poured by gravity and on most pistons the mold has two gates poured simultaneously through two spouts in the ladle. Proper filling of a mold is gaged by complete filling of the riser between the two gates. Proper control of pouring temperature and control of the cooling cycle before a mold can be opened constitute the main checks for quality.

Concentration on mold design makes it possible to produce intricate permanent mold castings with almost any form of cavity or coring. One recent example is found in the production of end covers for small electric motors in which the permanent mold castings combine several castings formerly made from cast iron. The mold is of special design incorporating hinged arms forming a part of the core. Another outstanding development was the design of a unique centrifugal mold for producing a large muff for cooling radial engine cylinders. This muff, made of aluminum alloy, contains a large number of long, thin-section cooling fins which require no machining.

Piston castings, ready for shipment to the customer, are produced in several ways. Most pistons are shipped in a rough-machined state—an "inspection-machining" procedure adopted by Sterling to eliminate rejects during finish-machining operations. This inspection cut facilitates an accurate visual inspection which is applied 100 per cent on all pistons. Other pistons are finish-machined in another section of the Sterling plant. The initial machining stage after molding is to shear the gates and riser in a single operation on a punch press. Then the castings are heat-treated according to specifications. This is done in another bay of the foundry, outfitted with a large battery of ovens operated under complete control of time and temperature.

For rough machining the foundry has a long bay containing a large battery of converted Sundstrand Stub lathes and other machines of stub-type tooled for high productivity. The relatively small percentage of pistons finish-machined here is routed to another building equipped for piston machining.

A large department is devoted to tool and die making. It is to be expected that this facility is of major importance, constituting a basic activity for the production and maintenance of all mold equipment. Piston machining facilities include conventional equipment supplemented recently by additions of Cincinnati Centerless grinders for cam grinding and Ex-Cell-O precision boring machines for piston pin losses.

Heart of the operation is an extensive engineering department concerned with the development of product design in cooperation with engine builders. It handles contacts with the customers, design of tooling and molds, trouble-shooting, materials specifications, and control of technical equipment.

Looking to the future, Sterling is in the process of installing large high pressure die casting machines for the production of special items such as small connecting rods, bearing caps, and other items of aluminum which are expected to replace ferrous castings and steel forgings in the postwar era. The company also intends to install forging equipment for the production of aluminum forgings for postwar use.

Like many other producers in the aluminum field, the company feels that after the war this light metal will find many useful applications on engines and other diversified equipment. They cite as unique advantages the fact that permanent mold castings possess extremely light weight, accuracy in form and finish, ofttimes making machining unnecessary, and the added advantage of exceptionally long mold life. The latter feature makes for lower amortization charges with consequently lower product cost.

To visualize some of the activity of this interesting plant, we have selected a number of views in various departments, illustrating features of foundry operations, rough machining, and finish-machining operations.

28 MORE PER HOUR
33 MORE PER HOUR
7.5 MORE PER HOUR
6 MORE PER HOUR
39 MORE PER HOUR
16.9 MORE PER HOUR
30 MORE PER HOUR
32 MORE PER HOUR
21 MORE PER HOUR
20.7 MORE PER HOUR
19 MORE PER HOUR
19.9 MORE PER HOUR
19 MORE PER HOUR
As the source of these production figures is confidential, the illustrations shown typify the products.
17 MORE PER HOUR
16.75 MORE PER HOUR
4514

Independent Survey Reveals Production Increases

By the Use of

VASCOLOY-RAMET *Tantalum-Tungsten* CARBIDE TOOLS

On a total of 62 different operations, 951 more parts were produced per hour under everyday shop conditions. Survey was made in one of America's leading plants.

If your shop is not using Vascoloy-Ramet Tantalum-Tungsten Carbide Tools, it may interest you to compare your production with similar production of another plant. Figures cover extensive variety of parts. Write us for "Before and After Figures".

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WORLD'S FINEST CARBIDE

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SURFACE FEET PER MINUTE
40 50 60 70 80 90
General H.S. Steel Cutting Range
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GENERAL CARBIDE CUTTING RANGE

Medical corpsmen urgently need transportation for desperately wounded men lying in a field rimmed by mortar fire. And Stinson "Flying Jeeps" land alongside to take them swiftly and surely to the rear.

Here at home, another Stinson plane—the Voyager—has carried out 65 per cent of the operations of the Civil Air Patrol. CAA records show that the Stinson Voyager is the safest personal plane ever produced in quantity.

The Stinson Reliant AT-19 is widely used by the British as a navigational trainer. And almost every airline in the United States uses Stinson planes to train and check their pilots.

THE VOYAGER 125

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The Voyager 125 is a product of Stinson engineering, designing, and production skill gained in our 19 years of experience in building quality personal planes—first for safe peacetime flying and then for tough battle flying.

The Stinson Voyager 125 is a family plane that carries the pilot and three passengers, with plenty of luggage space beneath the back seat. Powered by a 125-h.p. engine, it has a cruising range of 580 miles, a rate of climb of 670 feet per minute at sea level, and service ceiling of 14,000 feet. It has a maximum speed of 128 m.p.h. and a cruising speed of 116 m.p.h. It takes off, with flaps down, after a run of 550 feet, lands with a roll of 280 feet.

We welcome inquiries about the Stinson Voyager 125 and about our plans. The Voyager 125 will be coming off the assembly line 90 days after the time when the necessity no longer exists for allocation of all manufacturing facilities to production of airplanes for the Armed Services. Write to *Private Sales Director, Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Michigan.*

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You can obtain parts for your Stinson plane through your local Stinson Distributor, or direct from the factory. Stinson service will help keep your plane in the air!

Stinson

The Aircraft Standard of the World

DIVISION—CONSOLIDATED VULTEE AIRCRAFT CORPORATION
WAYNE, MICHIGAN

Aircraft Bevel Gears

(*Continued from page 27*)

The first step in the design of gears for a particular application is to study all of the conditions under which the drive must operate. The type of gear to be used should be based on a consideration of speed, power, type of mounting and requirements of operation. Where conditions are such that either a straight bevel or Zerol could be used, it is desirable to make the design such that Zerols can be incorporated without change. There have been several instances recently where production problems could have been simplified by incorporating ground Zerols in place of straight bevels. However, major changes in the original design would have been required to remove hub projections (see Fig. 2) which prevented the cutting of Zerol teeth.

Spiral bevels are strongly recommended where pitch-line peripherial speeds exceed 1000 fpm. In many applications, spiral bevels may be used to advantage at lower speeds because of greater smoothness and quietness. It is also well to remember that spiral bevels will, in most cases, provide a lighter overall construction due to their greater load-carrying capacity.

Practice for the last few years in determination of gear size in aircraft work has been first to select an initial gear size on the basis of the surface durability in pounds-per-inch-of-face. The maximum allowable load values for surface durability of ground spiral-bevel gears as used in aircraft are shown in Table I. For Zerol gears, the allowable loads are taken as one-half those for spiral bevels.

Experience shows that the effect of the rigidity of the mounting and lubrication cannot be too highly emphasized. The loads in Table I cannot be carried satisfactorily unless proper mountings and lubrication are provided. Because of the importance of proper mounting and lubrication we find it advisable to base the loads with respect to surface wear on mounting conditions, rather than on an estimate of theoretical surface pressure.

For good design, the face width should not exceed 0.3 of the cone distance for spiral bevels or 0.25 of the cone distance for Zerols. Taking the gear ratio desired and the approximate gear size determined as above, a tentative diametral pitch can be selected from the chart shown in Fig. 3. It is of no importance in bevel gears to select an even or standard number for diametral pitch because with the method of cutting used, given tools or cutters are not narrowly restricted to certain pitches. For instance, the same cutter may be used satisfactorily for either 4 DP or 4.17 DP.

Having determined the approximate gear combination, the next step is to check for tooth strength and fatigue life. To obtain the stress in a bevel gear tooth by the modified Lewis method the load is assumed in the position where it is carried on one tooth. Thus in Fig. 4, the pinion tooth at the left is just on the point of engagement so that the tooth at the right carries the full load. This is the worst condition of loading on the pinion tooth, since further movement to the right brings another pair of teeth into contact to share the load, while further movement to the left brings the line of application of the force nearer the base of the tooth. Similarly Fig. 5 shows the worst condition of loading on the gear.

The tooth loads in spiral-bevel and hypoid gears produce a thrust along their axis, the direction of which depends upon the hand of spiral, the direction of rotation, and whether the gear is the driving or driven member. Bearing design must include proper provision to handle this thrust. A left hand spiral pinion driving clockwise (viewed from the back) tends to move away from the cone center while a right hand pinion tends to move toward the cone center because of the oblique direction of the curved teeth. The pressure angle and pitch angle, of course, also affect the thrust and may vary the

(*Turn to page 76, please*)

Aluminum Forgings all the way up to 8'6" propeller blade. The development of Aluminum Forgings by Wyman-Gordon for the war will give to post-war industry new production impetus through less weight, plus forging strength.
Wyman-Gordon
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MASSACHUSETTS
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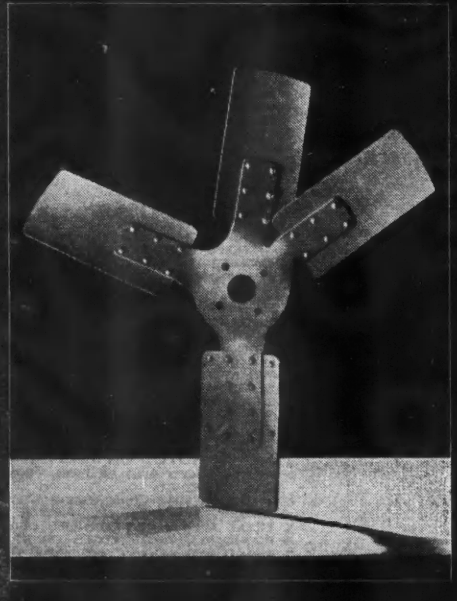
Forgings—Laboratory Controlled



THE SHAPE OF THINGS TO COME

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Out of these rugged tests . . . and from Hayes new wind tunnel and sound laboratories . . . will come the right product for the continued advance of engine design.

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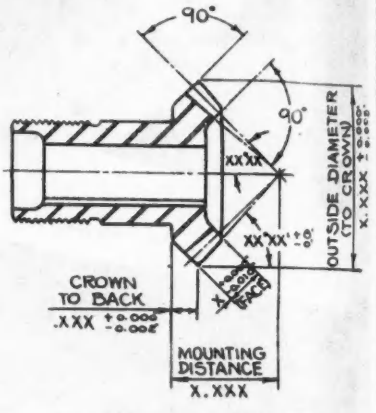
resultant direction. Where possible the hand of spiral should be selected so that the axial thrust will tend to move both gear and pinion out of mesh or, at least, tend to move the pinion member out of mesh.

The gear case should have sufficient rigidity to hold deflection and endwise displacement of the gears under operating loads to a minimum. A study of the various loads on the gears will suggest locations for ribs to reduce local bending in the case and provide a light but rigid construction. A means of inspecting the gears in mesh is desirable both from an assembly standpoint and for periodic check. An inspection hole and cover should be arranged so that the contact pattern can be observed on the teeth of both members of the gear set.

The correct setting or adjustment of the gears at assembly is important. Provision should be made so that the pinion can be set to correct mounting distance by means of a simple gage at assembly. After the pinion is correctly positioned, the gear can be adjusted to mesh with the mate in the position which gives the desired amount of backlash.

A study of the tolerances of the component parts of the assembly should be made to determine their affect on the mounting distances of the gear parts. Shims of sufficient thickness should then be provided in the design to permit adjustment of the gears to their correct position.

Spline-bored gears require a cylindrical centering fit to insure maintenance of concentricity of the splines with the gear teeth. On gears in which the splines must be hardened, it is recommended practice to take this fit on the minor diameter of the splines



STRAIGHT BEVEL GEAR DATA

NUMBER OF TEETH	XX
PITCH (D.P.)	X.XXXX
PITCH DIAMETER (THEORETICAL)	X.XXXX
SHAFT ANGLE	XX°XX'
PRESSURE ANGLE	XX°XX'
WHOLE DEPTH	.XXX
ADDENDUM (THEORETICAL)	.XXX
ROOT ANGLE (BASIC)	XX°XX'
TOOTH ANGLE	XX°XX'
CHORDAL ADDENDUM	XX°XX'
CHORDAL THICKNESS	.XXX
LIMIT POINT WIDTH	.XXX
MINIMUM TOOTH FILLET RADIUS	.XXX
TEETH IN MATE	XX

MATERIAL AND HEAT TREATMENT

SPECIFICATIONS
PRELIMINARY HEAT TREATMENT SPEC.
PRELIMINARY HARDNESS
HEAT TREATMENT SPEC.
DEPTH OF CASE
CASE HARDNESS
CORE HARDNESS
HEAT TREAT A TEST PIECE WITH GEAR

NOTES ON MACHINING

1. ALL SURFACES MUST BE FREE FROM TOOL MARKS AND SCRATCHES.
2. LIMITS ON FINISH DIMENSIONS ARE ±.010" UNLESS OTHERWISE SPECIFIED.
3. BREAK ALL SHARP CORNERS (X) RADIUS.
4. ROUND ALL TOOTH EDGES (X) RADIUS.
5. ROUND ALL KEYWAY AND SPLINE ENDS (X) RADIUS
6. MAGNAFLUX INSPECTION

OPERATION DATA

DRIVER OR DRIVEN	
DIRECTION OF ROTATION	
SPEED - R.P.M.	
MATING PART NO.	
BACKLASH IN ASSEMBLY	.XXX-.XXX

Fig. 6—Sample drawing of aircraft straight bevel gear

the major diameter to have clearance. Another method is to provide a suitable length of cylindrical fit at both ends of the splines and to use the splines only for driving. Since heat distortion may introduce both twist and out-of-round conditions in the splines, which cannot be corrected, it is important that the splines be of no greater length than is actually required for load transmission.

A sufficient amount of metal should be provided under the gear teeth to give proper support. The general rule is that the rim thickness under the teeth should not be less than the whole depth of the tooth, at the ends of the teeth as well as at the middle.

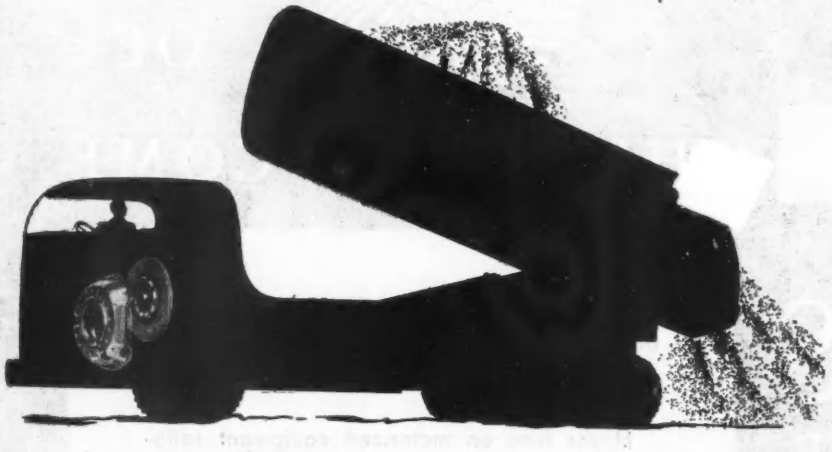
Splash lubrication is generally satisfactory for peripheral speeds up to

(*Turn to page 78, please*)

Over a Quarter Century of CLUTCH Building EXPERIENCE

Your* Engineers Can Use *Now

Because of the wide variety of experience and clutch building facilities at their command, our engineers are solving the most difficult power transmission control problems. They can help *you* avoid LOST reconversion TIME on either standard or out-of-the-ordinary clutch applications. Arrange *now* to benefit from their clutch recommendations for *your* post-war designs. They'll be glad to plan with you.



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ROCKFORD CLUTCH [FORMERLY KNOWN AS DRILLING MACHINE] **DIVISION** BORG-WARNER CORPORATION
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This Synthetic Rubber Valve Disc SEALS SECURELY

because it is

1. *Tough and durable*
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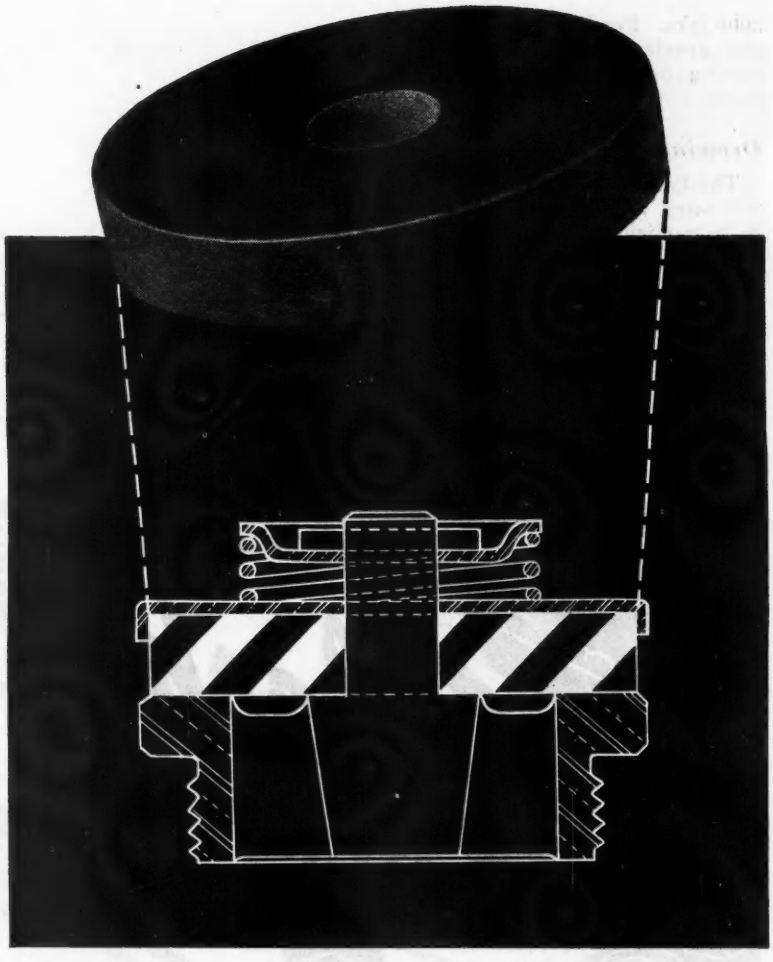
3. *Water resistant*
4. *Precision molded*
5. *Permanently resilient*



This spring-loaded valve disc, made of one of Armstrong's many Synthetic Rubber Compounds, provides a dependable seal under heavy-duty conditions. It is precision molded, assuring the smooth, true face essential to a tight seal. It is specially formulated to withstand constant pounding. It will not deteriorate. It resists oil and is impervious to hot or cold water. Moreover, the resiliency of this gasket insures quiet, efficient operation throughout its long life.

In addition to synthetic rubber compounds, Armstrong supplies the automotive and aviation industries with many other types of sealing materials for uses where temperatures do not exceed 300° F. These include cork compositions, cork-and-synthetic-rubber compositions, fiber sheet packings, and rag felt papers.

Armstrong's free booklet, "Gaskets, Packings, and Seals," gives specification and application data on these materials. Send for your copy today. Write, too, for unbiased recommendations on your specific sealing problems. Address Armstrong Cork Company, Gaskets and Packings Department, 1504 Arch Street, Lancaster, Pennsylvania.

MATERIALS AND SPECIALTIES FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Tank strap cushions**
- **Composition roll goods**—with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, and anti-skid flooring.
- **Felts** for vibration-damping and soundproofing
- **Resilient floorings**
- **Carbureter floats** and other fabricated natural or composition cork specialties

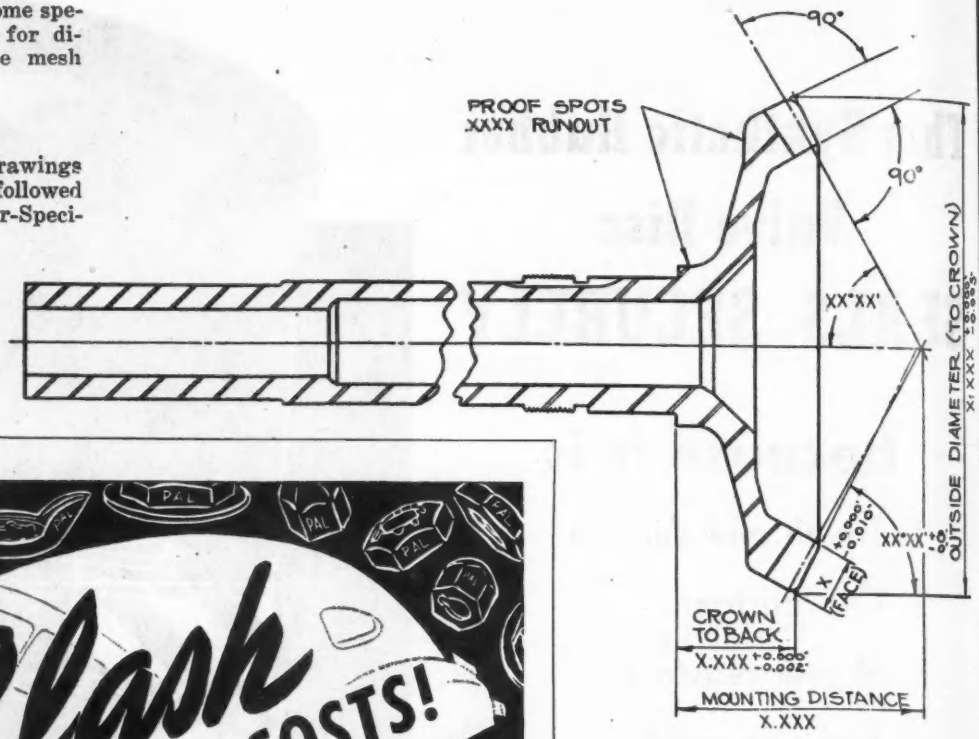
ARMSTRONG'S *Gaskets, Packings, and Seals*

2000 fpm. For higher speeds, some special provision should be made for directing or forcing oil into the mesh point.

Drawings

The type and scope of gear drawings will vary with the procedure followed in a particular plant. A Gear-Specification Drawing, containing all the dimensions which define the gear and those which are established by the relation of the gear to other parts, is usually required. These dimensions include the gear teeth specifications for proper operating contact with the mating gear. Specifications of material and heat treatment, and notes for inspection limits also should be given. A sample drawing illustrating the necessary information as outlined above is shown in Fig. 6 for straight bevels and in Fig. 7 for spiral bevels. The amount of information on these sample drawings is sufficient where both the gear and its

(*Turn to page* 80, *please*)



BEVEL GEAR DATA

NUMBER OF TEETH	XX
PITCH (D.P.)	X.XXXX
PITCH DIAMETER (THEORETICAL)	X.XXXX
SHAFT ANGLE	XX°XX'
PRESSURE ANGLE	XX°XX'
SPIRAL ANGLE	XX°XX'
HAND OF SPIRAL	R OR L
ROOT ANGLE (BASIC)	XX°XX'
ADDENDUM (THEORETICAL)	.XXX
WHOLE DEPTH	.XXX
CIRCULAR THICKNESS (THEORETICAL)	.XXXX
PART NO. OF MATE	
NUMBER OF TEETH IN MATE	XX

MATERIAL AND HEAT TREATMENT

SPECIFICATIONS
PRELIMINARY HEAT TREATMENT SPEC.
PRELIMINARY HARDNESS
HEAT TREATMENT SPEC.
DEPTH OF CASE
CASE HARDNESS
CORE HARDNESS
HEAT TREAT A TEST PIECE WITH GEAR

NOTES ON MACHINING

1. ALL SURFACES MUST BE FREE FROM TOOL MARKS AND SCRATCHES.
2. LIMITS ON FINISH DIMENSIONS ARE ±0.010" UNLESS OTHERWISE SPECIFIED.
3. BREAK ALL SHARP CORNERS (X) RADIUS.
4. ROUND ALL TOOTH EDGES (X) RADIUS.
5. ROUND ALL KEYWAY AND SPLINE ENDS (X) RADIUS.

BEVEL TOOTH CUTTING AND GRINDING DATA

DRIVER OR DRIVEN	
DIRECTION OF ROTATION	
SPEED-R.P.M.	
MINIMUM TOOTH FILLET RADIUS	.XXX
BACKLASH IN ASSEMBLY	.XXX-XXX
SUMMARY NO.	

PRECISION WORK

Fig. 7—Sample drawing of aircraft spiral and zerol bevel gears

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PARTS · COSTS!

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● Wherever your new car designs now call for a jam nut—lockwasher and nut—plain washer, lockwasher and nut . . . replace with a single, inexpensive self-locking PALNUT. This saves 50% in time and labor —cuts fastening weight 60-90%—reduces space, while providing vibration-proof security.

Self-Locking PALNUTS are single thread, spring tempered steel locknuts, easily, speedily applied with hand or power drivers. They are very low in cost, light in weight, require only 3 bolt threads space.

Self-Locking PALNUTS are available in many types for various applications, in a wide range of standard sizes. Send details of your assembly for test samples and data. Write for Palnut Manual No. 2 showing principle, advantages, application, sizes, etc.

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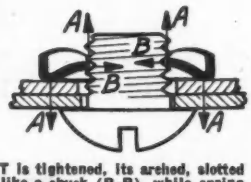
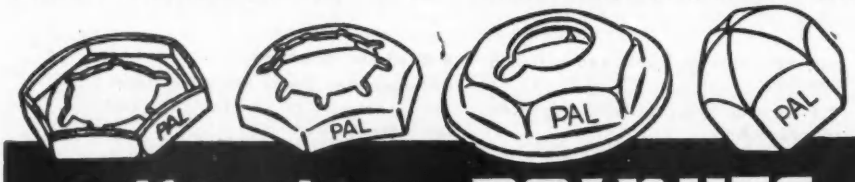
***DOUBLE LOCKING ACTION !**



When the PALNUT is tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the part (A-A), securely locking both.



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mate are supplied by the same shop, because the responsibility for satisfactory tooth contact then lies with one maker. If, however, the same gears are to be made in different shops, duplicate sample or master gears should be provided each manufacturer to maintain interchangeability.

On the sample drawings shown in Figs. 6 and 7, all parts of the gear blank are defined by a minimum of dimensions. The only dimensions shown on the drawing proper are those actually required for the machining of the blanks; all others are in table form. Also note that the method of dimensioning definitely relates the crown point of the teeth to the mounting shoulder. Often drawings of gear blanks show dimensions in relationship to the cone center of the gear, causing confusion in the shop in turning the blanks. The cone center is a theoretical reference point in space and is of no value to the machinist in the manufacture of the blank.

In general the best overall results are obtained with case-hardened gears. It is a recognized fact that the case-hardened section adds considerable strength to the gear tooth in addition to providing a very good wearing surface.

It is essential that the gears be inspected to insure that they run smoothly and quietly and that they conform to the specified manufacturing tolerances. For this purpose testing machines are provided which have an axial adjustment for both gear and pinion, and usually an offset adjustment for raising or lowering the axis of one member vertically with respect to the other. Runout is characterized by the tooth contact shifting back and forth endwise of the teeth around the gear and is easily observed in a running test.

Bevel gears cost no more than any other gear and experience has brought their design to the point where the service problem has been practically eliminated.

Morris Field Tractor

(*Continued from page* 34)

Operation of the five speeds of the main gearbox is effected by a single lever, all ratios being obtained by double helical gear trains, dog clutches and a special form of compound countershaft. The transfer gearbox transmits the drive to the front and rear wheels, or if desired, to the rear wheels only. Alternatively, it can be used to operate an engine-driven winch gear without transmitting torque to any of the wheels. A separate lever is provided for the transfer gearbox, with three positions, i.e. (a) rear wheel drive only, (b) four-wheel drive and (c) winch gear.

Incorporated with the five-speed gear selector mechanism is a device that necessitates engagement of the front wheel drive before the main gear lever can be moved to the first speed position. The object of this is to prevent the full torque through the low-low gear ratio being carried by the rear axle drive shafts, which otherwise might be unduly stressed in some circumstances.

Propeller shafts with Hardy Spicer universal joints transmit the drive to front and rear axle units, both of which are of the spiral bevel full-floating type with the differential casing somewhat offset. Tracta constant velocity joints are used with the front axle drive shafts. The steering layout is conventional.

With a gross weight of 11,000 lb, the tractor when towing a gun and limber weighing 8000 lb will climb grades as steep as 33 per cent (1 in 3) with the gear (67.9 to 1) in use.

The winch gear, through its 120 feet of cable, exerts a maximum pull of 10,000 lb. The speed of the cable at an engine speed of 1000 rpm is 78 fpm.

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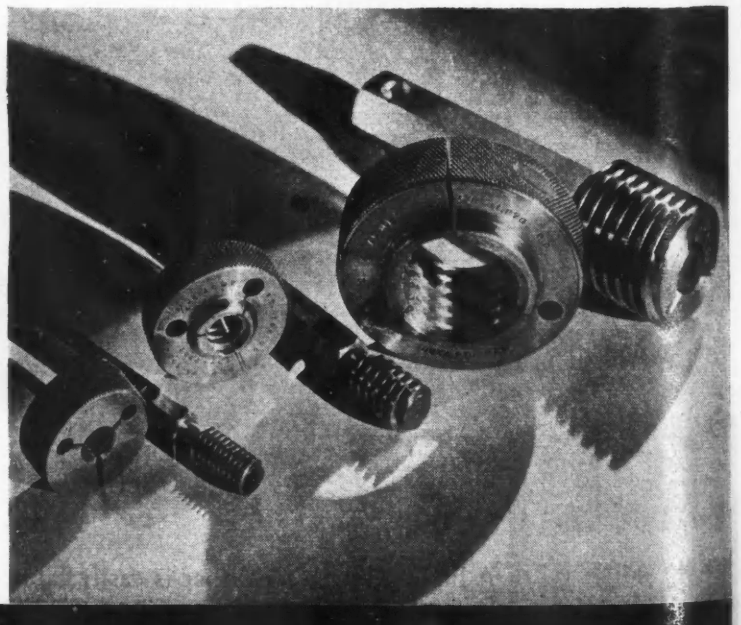

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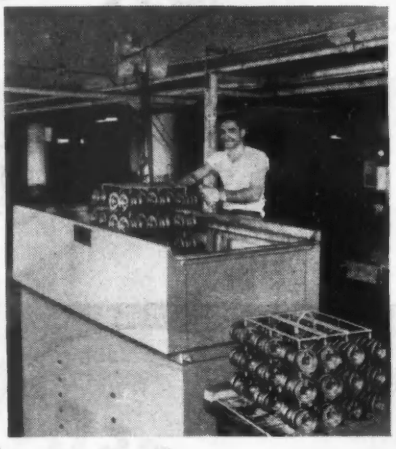

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No Automobile Production Prior to Fall of Germany

(*Continued from page* 48)

ceptance and delivery of unrated material orders and in the second or third quarter after that to abolish the CMP and substitute a simple priority plan. In both cases, of course, material needed for war work would come first. He estimated that overall cutbacks during the first quarter after V-E would total 12 per cent, rising to 20, 30, and 35 per cent in the following three quarters.

WPB has had a group working to determine the exact number of machine tools each company needs with the idea of getting them produced, Krug said. The group works directly with the machine tool builder, checking his orders from individual companies against the military order boards. Careful scheduling, in cooperation with procurement agencies, will permit sandwiching some of these essential machines into the schedule. In some cases certain military orders may be deferred a month, if that can be done without impairing the war effort, to allow production of machines needed for reconversion. John S. Chafee, Director of WPB's Tool Division, reported that some machine tool builders have been released from production of war goods and that more soon will be freed in order to increase machine tool building capacity. Krug also pointed out that foreign Lend-Lease orders for civilian production would have to take a back seat for machines vitally needed for reconversion here.

Romney discussed briefly the steps that should be taken to prepare for reconversion. They are: advance decisions on disposal of materials, machinery work in process, etc. at time of termination; finding out what company-owned machines are going to be freed for car production; getting manpower for tool and die work; and getting pre-termination work on contracts out of the way. He added that meetings have been held between the industry and representatives of contract settlement boards, DPC, and war adjustment agencies.

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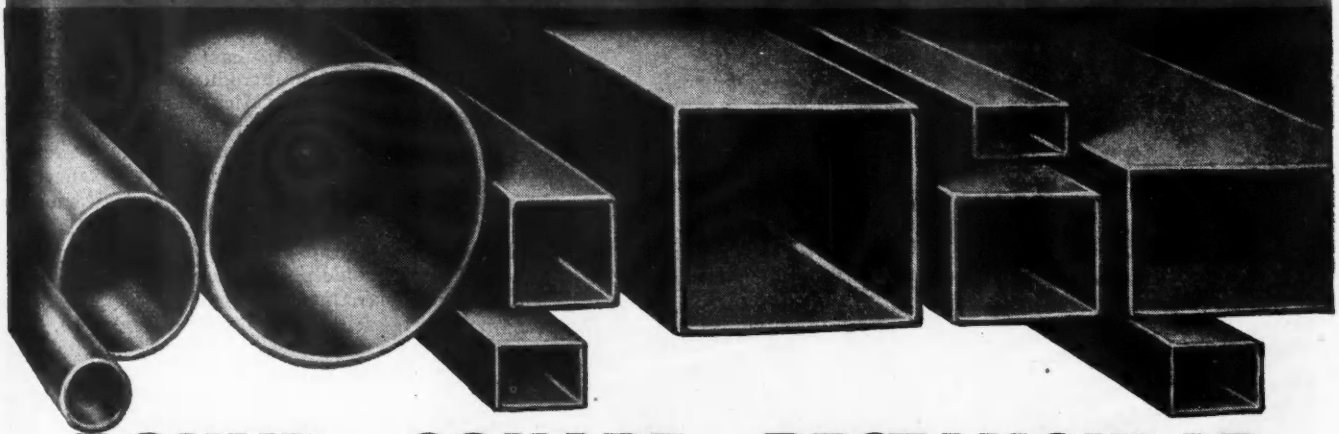

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CONVEYING EQUIPMENT

A-F CONVEYING MACHINERY

Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

New Production Equipment

(*Continued from page* 64)

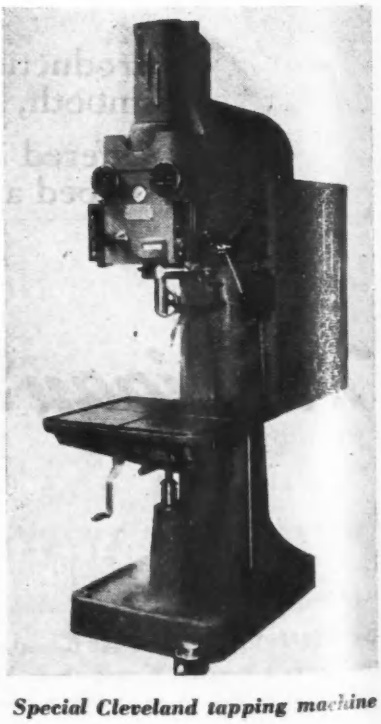
These blanks are now available in several of the larger sizes, with formed clearance angles, right hand or left hand, and in all standard grades of Kennametal. Complete tools of various styles—straight edge, lead angle, offset, etc., can now be furnished with the screwed-on tips, or separate standard blanks will be supplied to those who wish to make their own tools. Blanks of non-standard shapes and sizes having this feature may also be had for special tools, such as are used in shell turning or form cutting of radii and grooves.

A NEW solid cast steel cutting tool is being introduced by Crobalt, Inc., Ann Arbor, Mich. The tool is produced by melting a special cobalt steel alloy in an indirect arc rocking electric furnace, superheating to well above 3000 F. and casting in molds of the approximate tool size. This process is said to give the metal a preferred grain and carbide particle size at the time of casting, thus doing away with the need of forging and later heat treating.

Powersteel solid tool bits are supplied hardened and ground, ready for use. They can be resharpened and used as long as the tool can be held in the holder. They are available from stock in nine standard sizes of square bits and five sizes of rectangular bits.

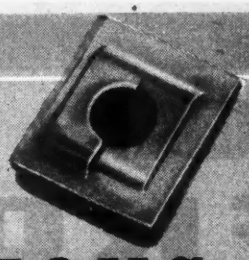
THE tapping and threading machine shown in the accompanying illustration was developed and built by the Cleveland Tapping Machine Company,

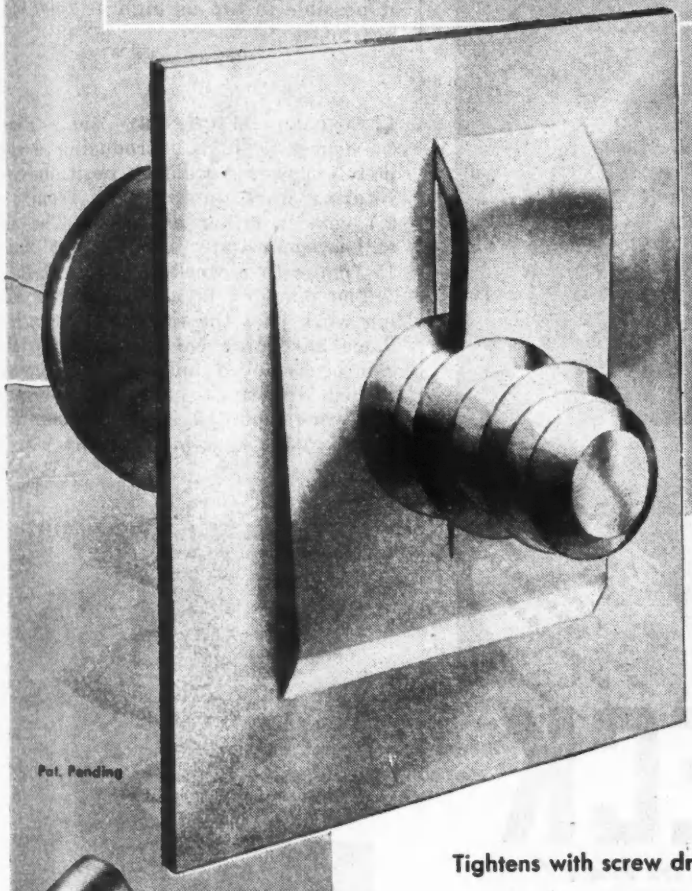
(*Turn to page* 86, *please*)



Special Cleveland tapping machine

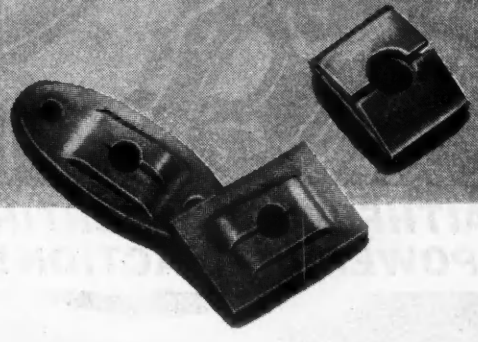
Meets and Exceeds AAF SPECIFICATIONS

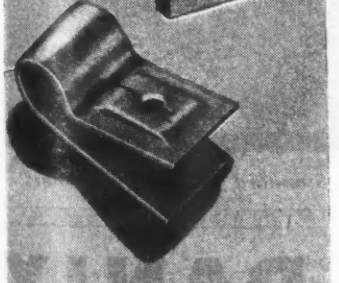


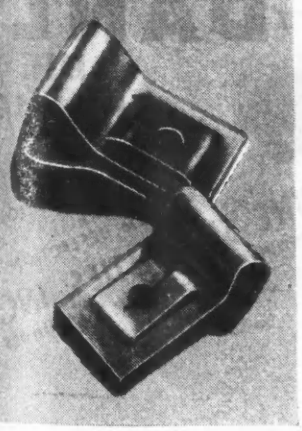


Pat. Pending

THAT'S "STALOCK," THE ALL AROUND FASTENER." IT MEETS AND EXCEEDS SPECIFICATIONS (AAF 25533) AND HAS BEEN AWARDED AAF RATING!







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The rapid approach and retraction of the spindle is controlled by two air cylinders which exert no air pressure on the spindle when tapping. The rapid approach can be set to stop within .010 in. of the hole to be tapped. The rapid retraction becomes effective the instant the tap leaves the work. The tap is removed at twice the tapping speed. These factors are said to make it possible to tap as high as 2000 holes per hour.

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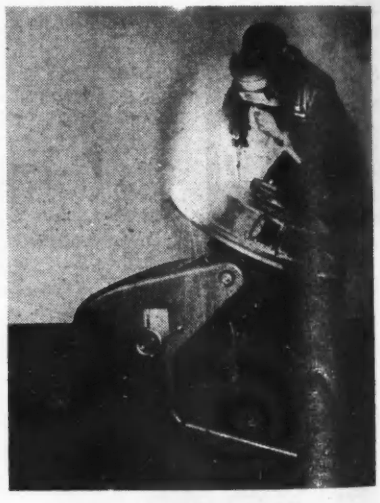
The machine is adaptable for moving work past the torch and quench in flame hardening operations. The table can be removed and various jigs attached directly to the spindle. Also, the work mounted on positioner table

(*Turn to page* 88, *please*)



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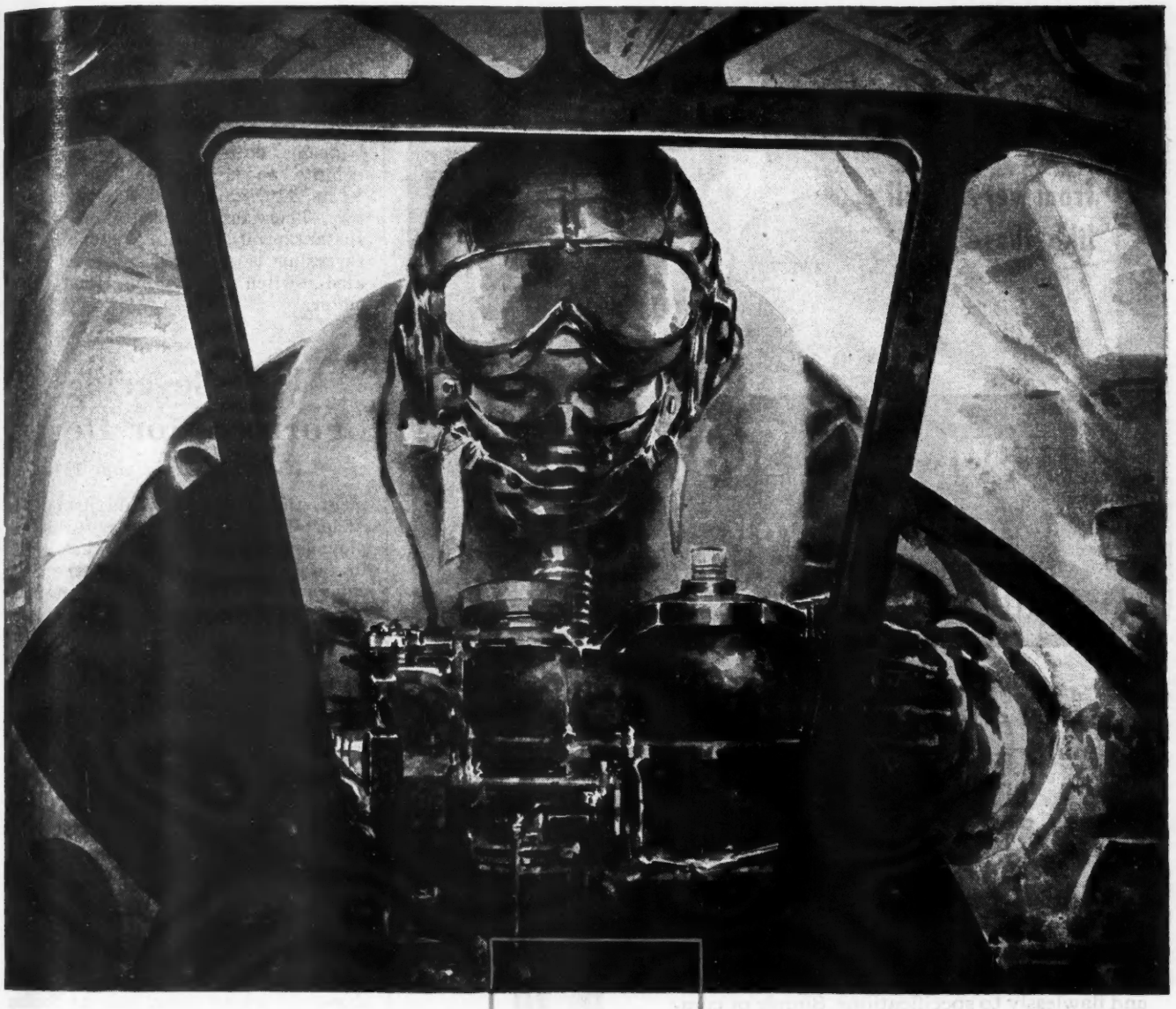
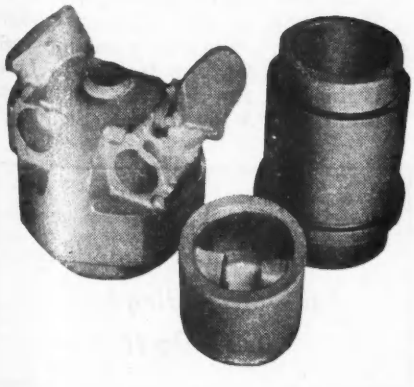


When you set your sights on tomorrow's competition



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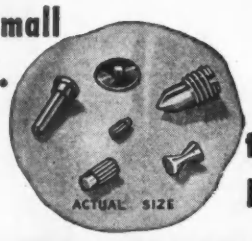

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may be tilted to any angle, permitting worker to operate at one position and so facilitate the inspection of parts or assembly operations.

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The Beveridge Formula for Decay

(*Continued from page* 15)

ment, this abolition would have to be undertaken." He also says, "Full employment means ensuring that outlay in total is sufficient. Only the State can ensure that . . . The State cannot escape ultimate responsibility for the general direction of outlay by reference to social priorities, however much it may be guided in its direction by preferences expressed by citizens, in buying as well as in voting."

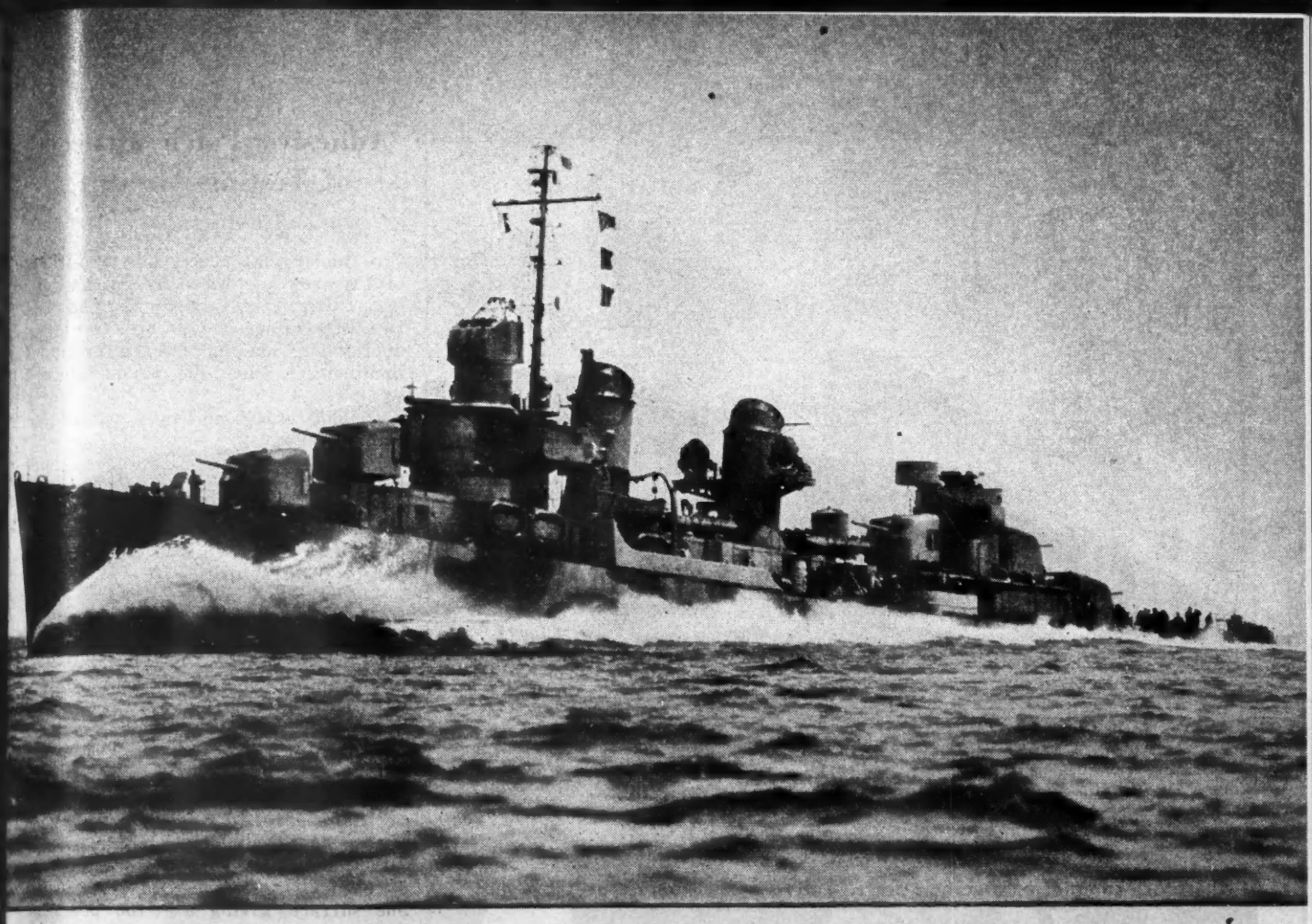
"It should be accepted as a general citizen duty," the author says, that workers should take jobs wherever labor at fair wages, and what are fair wages is to be determined by the State, is in demand for "service means doing what is wanted, not just pleasing oneself."

These requirements are essential in any type of over-all planned economy and so also are the other Beveridge provisions. The State must run the show, the whole show, and no fooling about it. He makes it crystal clear that there can be no successful planned economy without dictatorship.

"Full employment," Sir William maintains, "cannot be won and held without a great extension of the responsibilities and powers of the State exercised through organs of the central Government. No power less than that of the State can ensure adequate total outlay at all times, or can control, in the general interest, the location of industry and the use of land. To ask for full employment while objecting to these extensions of State activity is to will the end and refuse the means."

There will be many critical reviews of this book. A masterly one has been written by Professor Harley L. Lutz, of Princeton, for the Tax Foundation. It is entitled "A Short Cut to Serfdom."

Every Day There Is a Chance to Do Something for Our Fighting Men. Let's Do It



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How fine these ships are is well expressed in the following extract from a letter written by the commanding officer of the destroyer pictured above:

"A word of praise for the grand job the Bath Iron Works did on the ship. She has been through h—l and high water and never failed us. Keep on building ships as fine as this . . . We have put on nearly one hundred and fifty thousand miles and she is as good as new."

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Galvanized work on these ships is first cleaned with a Pennsalt Cleaner to insure a finish which will withstand the extreme corrosive conditions of the sea.

Paint stripping is another important use of Pennsalt Cleaners at the B.I.W. In fact there is a Pennsalt Cleaner scientifically designed for nearly every type of metal and maintenance cleaning.

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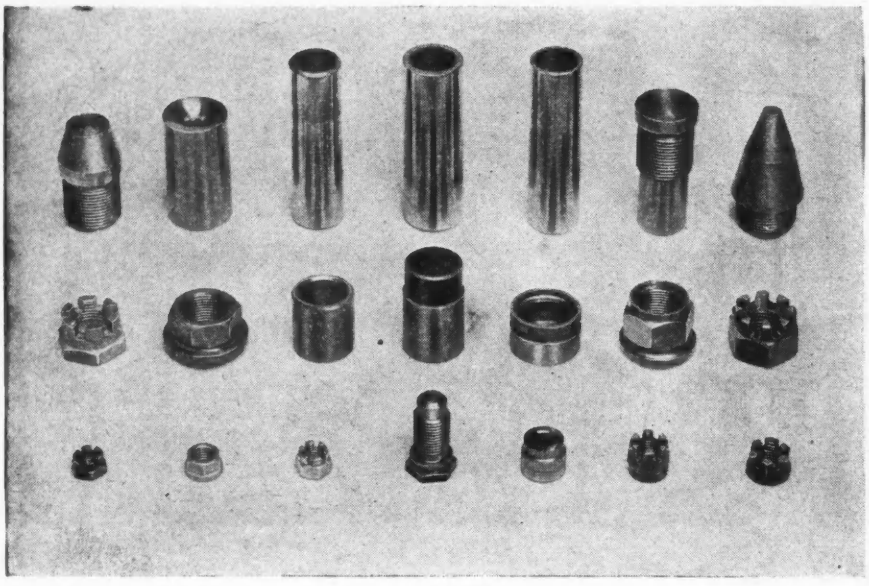

. . . made in 10 to 25 seconds and held to .002" limits . . .

These are samples of precision parts of ferrous and nonferrous alloys that have been made by BESSEMORE. On each of them, the screw machine work was completed within 10 to 25 seconds and .002" tolerances were maintained. The grinding work is held to .0001" (tenth). Many of these parts were bottle neck problems in the war program. BESSEMORE specializes in precision screw machine manufacture . . . making more of them better. Our engineers will be glad to make recommendations without obligation. . . . Send us your blueprints.

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Adhesive Patch Method of Testing Aircraft

(*Continued from page* 23)

ture under load since only about 1/3 of the area is covered by patches.

e. Finger tip control of load and rate of loading, and permits rapid reduction in loading in the event of imminent failure due to a localized weakness.

f. Load is automatically relieved on failure.

g. Readily permits loading to limit loads and unloading to determine if any permanent set has occurred up to operating loads.

h. Ideal for dynamic and fatigue testing of structures.

i. Aircraft can be tested without turning over on their back.

j. Safety to personnel conducting tests.

k. Minimum personnel actually required to conduct tests.

l. Better accuracy of loads and their distribution.

In the Dead Load Method the wings of the static test airplane must be inverted in order to get the shear, bending moment, and torsion in the proper direction for any particular design condition. Thus all the load is piled on one surface, giving a +100 per cent and 0 per cent distribution between the surfaces. However, the actual aerodynamic loads for most airfoils are distributed approximately +20 per cent and −80 per cent respectively.

The 100 per cent positive loaded surface should have only 20 per cent positive load whereas the other surface, which has no test load, should be loaded to 80 per cent negative load. To test wing structures by this method, the designer may be forced to design wing ribs and skin panels for static tests instead of for flight loads. The exact pressure distribution, in the right ratio and direction, can be obtained with the Adhesive Patch Method. Some airfoil sections have pressure distribution ratios of −90 per cent and +10 per cent or greater. The test set-up of wings having such sections can be sim-

(*Turn to page* 92, *please*)

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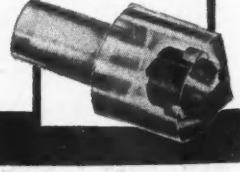

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plified by omitting the compression patches and by loading the tension patches to —100 per cent load since the difference is small and since both positive and negative wing load condition tests are conducted.

An excellent example of the importance of proper distribution of loads between upper and lower wing surfaces was demonstrated in static tests conducted at Wright Field on a plywood wing of an airplane used by the AAF. A number of failures of this wing was experienced in service. Dead Load tests were conducted on a new wing and on a wing having considerable time in service to determine the extent of deterioration of the wood or glue under service conditions. These tests showed both wings to be equal in strength, failure occurring in the spars at 115 per cent design load. Since many accident reports indicated that primary failure occurred in the plywood covered leading edge, a special test (see drawing) of the wing was made with tension patches on the upper surface (lower with wing inverted for the test) of the leading edge for negative air loads over the L. E. section, dead load on the lower surface of the L. E. section for positive air loads, and dead load on the fabric covered portion of the lower surface of the wing aft of the front spar. Failure of the inboard ribs occurred at 55.7 per cent design load due to tension failure of the light plywood gusset at the attachment of the leading edge block and the lower rib chord. Due to the long span of this rib chord, the loads produced a tensile stress, from bending, of sufficient magnitude to cause failure of the gusset at its free edge. In the dead load tests this edge of the gusset was subjected to compression stresses from bending. This point of weakness was substantiated by discovery of similarly cracked ribs on a service airplane and similar failures on crashed airplanes.

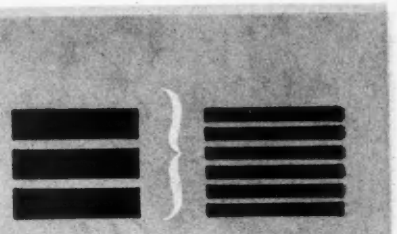
Experience with tension and compression patches shows that sponge rubber of one inch thickness has no effect on the stress distribution or on the shear and compression wrinkle patterns of the skin. Since only approximately 1/3 of the surface is covered by patches, there is ample room between the patches for observation of the structure under load and for installation of strain gages.

The finger tip control of loading by the hydraulic system is ideal in that, by proper design of the test set-up, it is possible for one operator at one control valve to load or unload the structure at will. Design requirements specify that no appreciable permanent set or yield of the structure shall occur at limit load, defined as the maximum expected load in service. Thus in the test program it is a simple matter to check for this requirement. With the operation of increasingly larger aircraft at extremely high gross weights and correspondingly lower load factors, the importance of dynamic and fatigue

(*Turn to page 94, please*)

The new *High-solids lacquers* save money

High-solids lacquers mean thicker coats . . . therefore fewer coats. This saves you money—in the five ways shown, and perhaps others as well. You can estimate just how large your savings will be when you get the full facts from your own lacquer supplier. Ask him about the *new* high-solids lacquers he is developing.



High-solids nitrocellulose lacquers deposit thicker films at spraying viscosity, give you the same finish with fewer coats.

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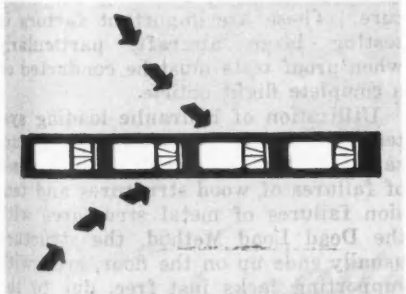

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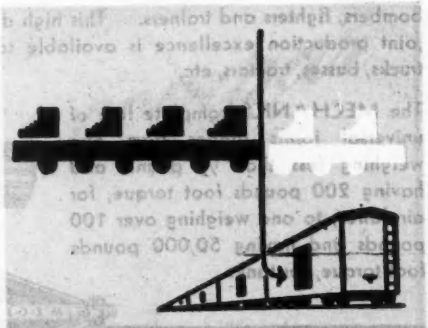

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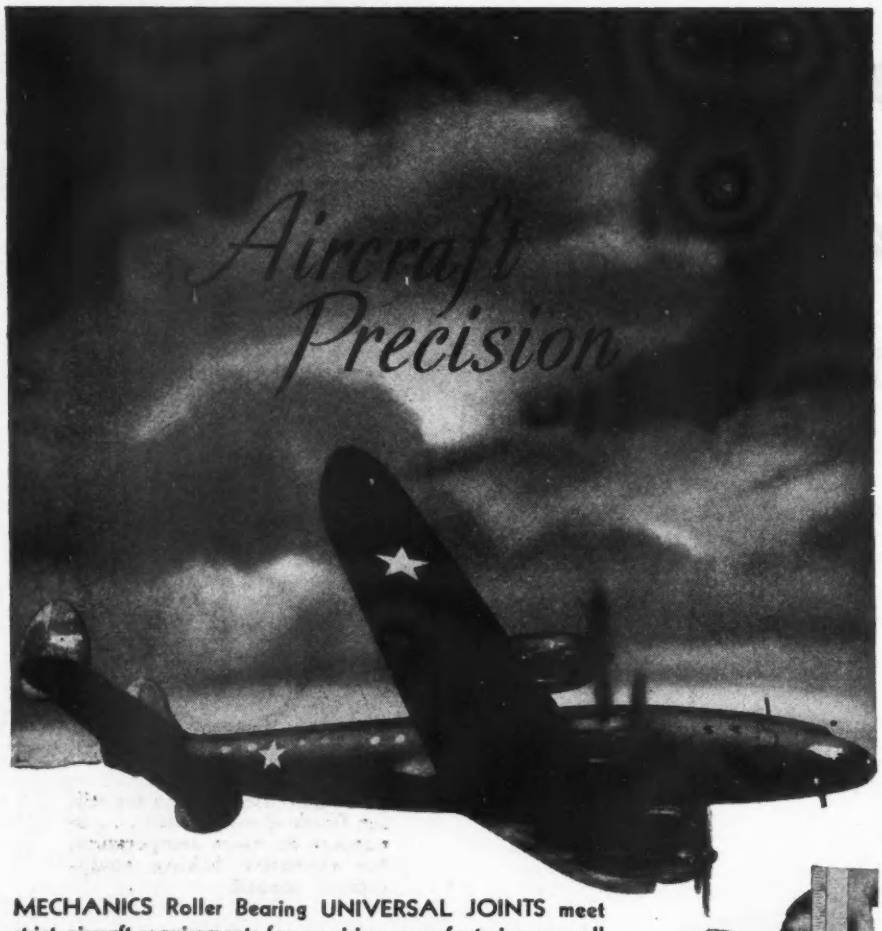

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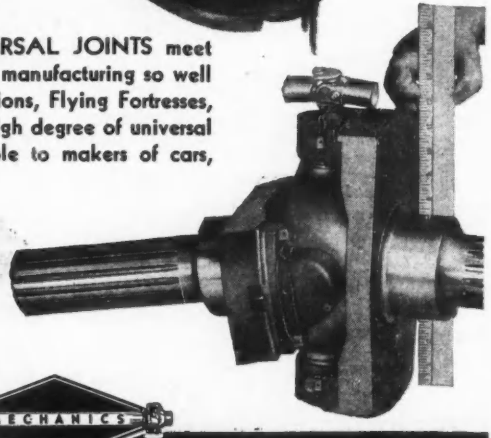

MECHANICS

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corporation
2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.

tests of aircraft structures has been realized by the industry. This system can be used directly for such investigations by manual or automatic operation of the control valve.

Depending on the capacity of the pumps and volume of the hydraulic system the load can be applied in a matter of seconds or minutes, compared to hours by the Dead Load Method. This time factor is extremely important in the testing of wood structures since the strength of wood is affected by the time of loading. The strength allowables for wood are based on a loading time of only three seconds.

A very definite advantage of this system is the control at or near failure of the structure. By use of a bus or common hydraulic supply system the pressure is automatically relieved on sudden failure, allowing time to shut off the loading valve and prevent further damage to the structure. When failures are incipient, the operator can stop or control the rate of loading to permit close observation and study. With dead weight loading it is generally difficult to distinguish the primary cause of failure from the secondary effects due to the extensive damage resulting from the potential energy of the dead weight.

With the Adhesive Patch Method it is not necessary to turn the airplane on its back or to disturb the structure by cutting holes or building in special clips or fittings for loading points. The rubber pads can be easily removed by a solvent without affecting the structure. These are important factors in testing large aircraft, particularly when proof tests must be conducted on a complete flight article.

Utilization of hydraulic loading system with this method assures maximum safety to test personnel. In the cases of failures of wood structures and tension failures of metal structures with the Dead Load Method, the structure usually ends up on the floor, even with supporting jacks just free, due to the sudden release of potential energy of the weight. By necessity personnel must remain near the structure for handling jacks and observation of the structure. Any complete collapse is a

(*Turn to page* 96, *please*)

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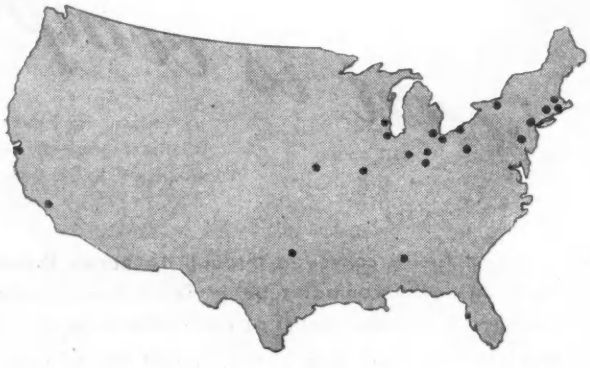

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safety hazard and generallly results in damage to steel scaffolding, jacks, jigs, and scales and in further damage to the remaining structure.

Some other methods used by the industry for testing aircraft structures hydraulically are as follows:

a. Tension Bolt Method: Holes are drilled through the structure for applying loads by tension rods, attached to bearing blocks at various points along the spars and ribs on the opposite surface and extending through the structure.

b. Formers Method: Utilizes heavy formers made in halves and accurately fitted to the exterior surface. They are bolted together and must have sufficient rigidity for taking off the load by cables or rods, properly located at the center of load for the area.

c. Clip Method: Uses an especially made structure having clips or fittings built in expressly for taking off loads by means of cables or rods.

d. Combination of Methods: Such as Adhesive Patch and Formers Methods, Adhesive Patch and Dead Load Methods, Formers and Dead Load Methods, etc.

The Adhesive Patch Method is the only one which distributes the loads properly between surfaces and which makes possible the testing for negative pressures. The Tension Bolt and Clip Methods affect the basic structure by adding holes or slots, which may occur in critically stressed areas. Such effects are not desired on flight articles for proof tests.

Although more time is required in making set-ups for the Adhesive Patch Method the overall time required for tests is not appreciably more, considering that accurate investigation and additional research is made possible and that only minimum actual test personnel is required for operation of valves, reading deflections, and observing the structure. Furthermore, as equipment is developed and more experience is gained in the use of this method it is believed that the total time required for structural tests will compare favorably with that for the Dead Load Method.

It is the opinion of the author that the Adhesive Patch Method will replace other methods for structural testing of aircraft and will be used more extensively in the future to investigate the effect of dynamic and fatigue loads on aircraft structures.

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Super State Cartels

(*Continued from page* 18)

ment should be vigilant in opening and preserving trade opportunities abroad for American business and every effort, compatible with our national interest, should be made to expand world trade. Our volume of world trade, proportionately small as it has been, is of great importance to our economic life, particularly to those industries largely dependent upon export business. But this foreign trade is not worth the price, if that price is abandonment of our competitive enterprise system and placing our domestic economy in a totalitarian strait jacket.

Finally we hear it said our participation in super-state cartels is inevitable. The argument goes that most of the world has embraced cartels and there is nothing that we can do about it. Thus, we are urged to climb aboard the cartel bandwagon, even though it means the destruction of a system at home which has given our people the highest standard of living ever achieved anywhere at any time upon this earth.

As Friedrich Hayek wrote in his excellent book, "The Road to Serfdom," nothing in social evolution is inevitable unless thinking makes it so. Who can be certain that other nations will remain wedded to the cartel system? Events in Europe have not progressed far enough to indicate definitely the political and economic desires of the people upon that continent. Nor are the English united in support of cartels. Only recently Prime Minister Winston Churchill called upon the Conservative Party to make private enterprise versus collectivization, and liberty versus controls, the issues of the forthcoming election. The London Economist weekly thunders that cartels and other forms of collectivism are will o' the wisps leading Britain to disaster.

Assume, however, that we must live in a world which outside our borders is wedded to the cartel system. Then we should use our great economic power to give world leadership and direction

(*Turn to page* 100, *please*)

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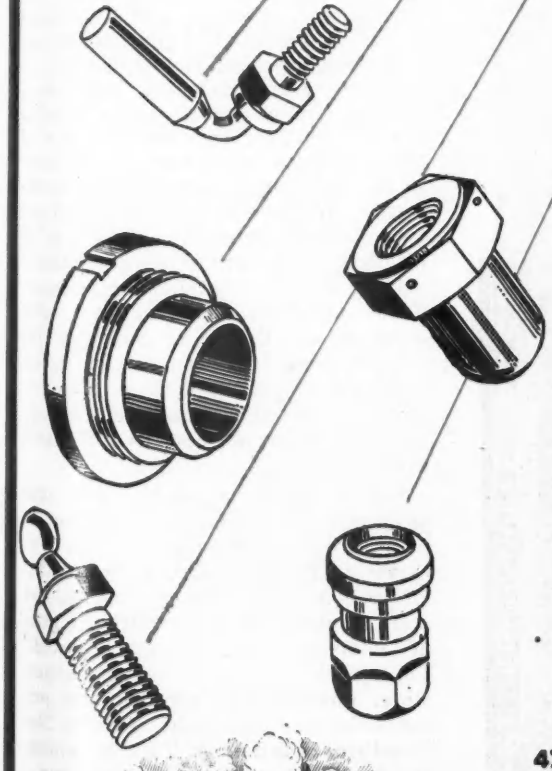
SKILL . . .

IN ENGINEERING AND PRODUCTION WORKS FOR YOU AT TOUREK!



It is our business to work for you—to produce screw machine products which fully meet your exact specifications. To do this, we have fully coordinated the vital factors of *engineering "know-how"*. . . . *modern equipment* . . . and *manufacturing experience!*

Precision? Why, it has been a "must" at Tourek for twenty-five years.

Why not consult us *now* about your post-war requirements for screw machine products? All our skill in engineering and production is available to produce for you . . . in any quantity . . . in any alloy . . . and in any size up to 2 5/8".

J. J. TOUREK MFG. CO.

4701 W. 16th Street **Chicago 50, Illinois**

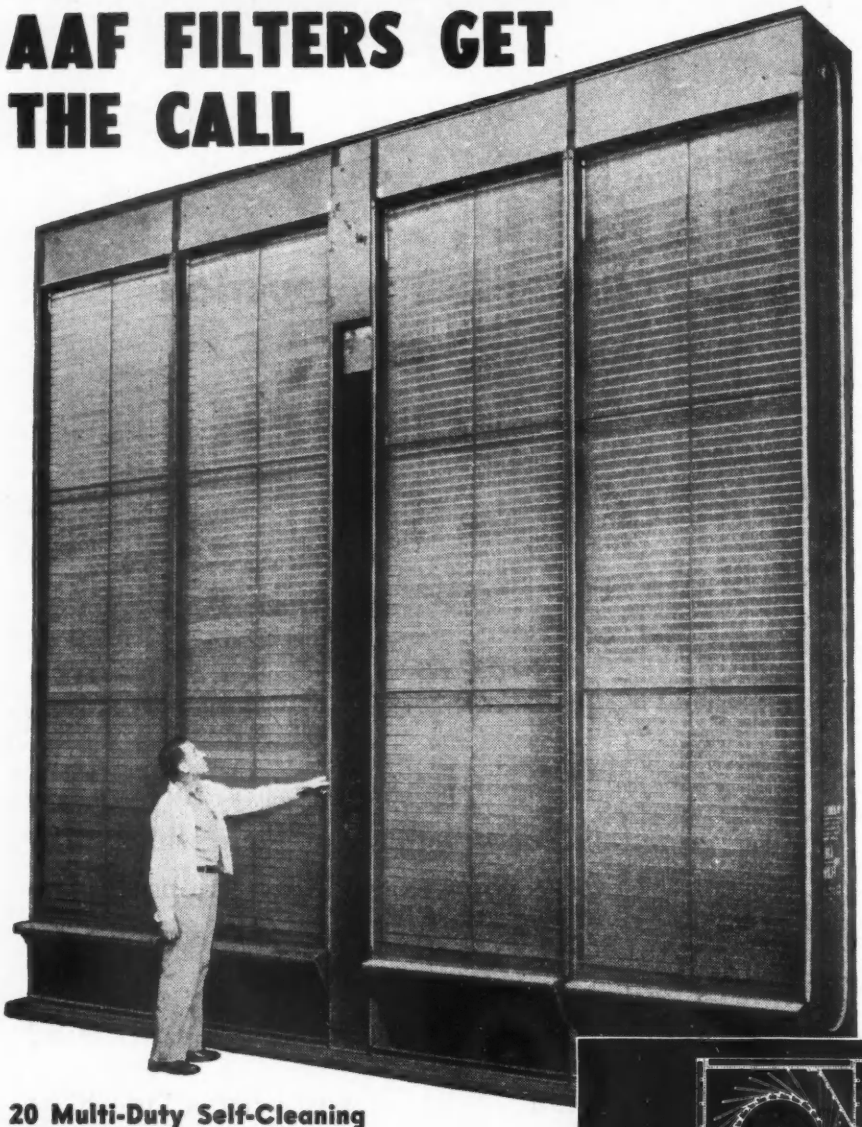
MAKERS OF THE FAMOUS TOUREK BALL JOINTS

ESTABLISHED 1920

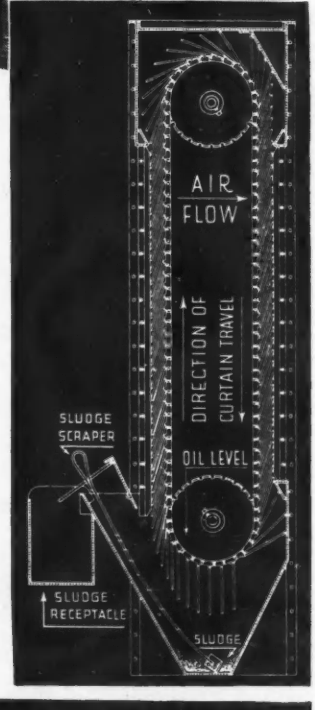
TOUREK

PRECISION SCREW MACHINE PRODUCTS

FOR TOUGH CLEANING JOBS AAF FILTERS GET THE CALL



20 Multi-Duty Self-Cleaning Filters like this one clean the air for the new G-E jet-propulsion engine plant, filtering the astounding total of 1,732,800 cfm of air. High efficiency is obtained with Multi-Duty Filters in removing soot and dust particles. Thus, they protect air conditioning equipment, plant machinery, precision production and provide more healthful working conditions. Choice of three types of filter panels, depending on dust condition and operating requirements. Continued improvement in the Multi-Duty Filter illustrates the AAF policy of "good enough is not enough if better is required." Ask for Multi-Duty Bulletin No. 241-A.



The filter panels in the curtain overlap like shingles when in the air stream, but are separated and individually cleaned and re-oiled as they pass through the oil bath.

AAF

AMERICAN AIR FILTER COMPANY INC.
INCORPORATED
449 Central Avenue, Louisville 8, Ky.—In Canada, Darling Bros., Ltd., Montreal, P. Q.

toward a more universal adoption of the competitive enterprise system. For instance, when the war in Europe ends there will be billions of dollars of Lend-Lease material that can be converted to peacetime industrial use—perhaps as much as thirty millions worth. In disposing of that surplus material in the countries in which it is stored, let us attach a condition that none of it may be sold or given to any enterprise that is a party to any cartel arrangement. There have been suggestions in Congress that the surplus war material in this country should not be sold to monopolistic enterprises. There is no reason for any less exclusive requirement for the disposal of surplus material abroad.

Again, why should not Congress enact legislation making it unlawful for America to lend money to foreign enterprises participating in cartel arrangements. Such action would apply to foreign loans the prudence and common sense exercised at home by bankers against lending to enterprises engaged in practices destructive of their markets.

Pending before the Senate are the Bretton Woods Monetary Agreements. One of these provides for establishment of the International Bank for Reconstruction and Development with a capital of eight billion, eight hundred million dollars, of which our Government would be obligated to provide two and three-quarters billions of dollars. In ratifying that agreement, why should not the United States Senate attach a reservation providing that no part of this sum may be loaned to any enterprise participating in cartel arrangements. We also could shut out of our rich market foreign monopolists set on discriminating against us and thereby driving us into a totalitarian economy. These countermeasures are not being proposed as things to be done, but merely suggested courses of action open to us as protective measures against countries, if any there be, attempting to strong arm us into cartel arrangements.

Let us not be beguiled by emotional appeals and glittering promises, but let us give sober reflections to the Wall Street Journal's recent observation that "No people ever entered the compulsory state through a door on which the price of admission was plainly posted." Through the doors of cartels—superstate, government-controlled and private—lies the road that leads to Nationalism, Isolationism, Totalitarianism, and finally, to another disastrous war.

Steel Output

The operating rate of steel companies having 94 per cent of the steel capacity of the industry was 95.6 per cent of capacity for the week beginning April 2, compared with 95.9 per cent one month ago and 99.5 per cent one year ago.

SHAVING not GRINDING FOR GEARS

Aircraft gears which formerly were ground in 40 minutes, floor to floor, are now being shaved in 5 minutes. Tooth surfaces of the shaved gear are as good or better than those of the ground gear and dimensional tolerances are just as closely maintained. Furthermore, in shaving there is no chance of surface cracks due to high frictional temperatures encountered in grinding.

Red Ring Rotary Shaving Machines correct gear cutting errors of helical angle, profile, eccentricity and roughness for any type of aircraft gear. Gears from ⅛″ to 36″ P.D. can be crowned to eliminate the danger of end bearing.

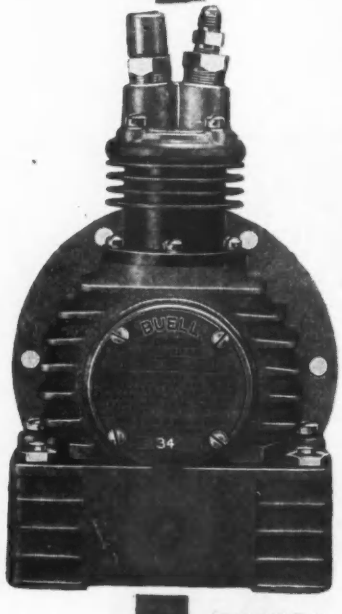
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS IN SPUR AND HELICAL INVOLUTE GEAR PRACTICE
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

RED RING PRODUCTS

Put the
BUELL AIR COMPRESSOR
in your post war picture



Why not investigate the possibilities of the Buell Air Compressor for your Post War Production. The many ways in which it can serve your needs may surprise you. Thousands are in active service in Canadian fighter and bomber planes. Their precision workmanship, demanded in aviation products, assures long service without frequent parts replacement. Designed for compactness and light weight, they will fit into surprisingly close quarters.

Put Air to Work!
It is Clean, Powerful and Reliable!

Write us, advising all details as to volume and pressure, etc., and our engineers will gladly aid you in solving your problem. We specialize in small, high speed compressors of the highest quality.

BUELL MANUFACTURING CO.
Dept. AA 2975 Cottage Grove Ave., Chicago 16, Ill.

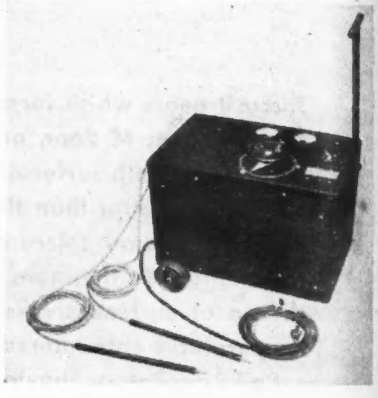
New Products

(*Continued from page* 42)

(6-32 thread) and plain shank for riveting. These, as well as the grooved stud, are provided in various lengths to suit application requirements.

Portable A-C Test Sets

Two portable a-c test sets, capable of supplying smooth test voltages from 0 to maximum rated voltages (2000 and 6000 volts), have been added to the line of the General Electric Company, Schenectady, N. Y. Either set can operate from any 115-volt, 50- or 60-cycle outlet, and both have a capacity of 2000 volt-amperes. The units were developed especially for testing Diesel-electric locomotives larger than 600 hp,



G-E 2 KVA test set

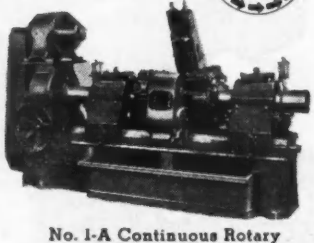
but have many industrial testing applications such as generators, motors, motor parts and appliances.

Both sets consist of a dry-type set-up transformer, variable-voltage autotransformer, two indicating voltmeters, voltmeter selector switch, signal lamp, air circuit breaker with magnetic overload trip and a supply switch. Two 15-ft shielded test leads with insulated handles and a 15-ft supply cord with plug are also included. One of the indicating voltmeters is used to measure voltages up to half of the maximum rating, and the other up to full test voltage.

(*Turn to page* 104, *please*)

Horizontal ROTO-MATICS

When high production is in demand on your machining problems your requirements can be met with a Horizontal Roto-Matic. Continuous, non-indexing operation together with roughing and finishing spindles insure maximum output. ***Bulletins 110 and 120*** are available for suggested solutions to your problems.



No. 1-A Continuous Rotary Drum Type Miller

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
6411 W. Burnham St. Milwaukee 14, Wisconsin

B-H
MANUFACTURERS OF SHEET METAL AND TUBULAR ACCESSORIES

CONTRACTORS TO ALL LEADING ENGINE AND PROPELLER MANUFACTURERS

PROPELLER CUFFS

B-H AIRCRAFT CO., Inc. LONG ISLAND CITY 1, NEW YORK

Ring Leaders

Since the earliest days of the automobile, American Hammered has consistently supplied piston rings that are a year or more ahead of the field. One American Hammered development *quadrupled* the flying time between engine overhauls in Allied war planes. Koppers Company, Inc., American Hammered Piston Ring Division, Baltimore, Maryland.

AMERICAN HAMMERED

Flexible Power Set-Up

There's a FLEXIBLE POWER Set-Up especially designed for every type of engine —designed to cssure, over a long period, maximum engine efficiency . . . minimum fuel and oil consumption. Each FLEXIBLE POWER Set-Up includes just the right combination of American Hammered COMPRESSION . . . FLEXIBLE POWER . . . and FLEXIBLE OILCUTTER Rings. FLEXIBLE POWER! Pioneered by American Hammered . . . tested on the Proving Grounds of global warfare.

American Hammered Piston Rings

A KOPPERS PRODUCT

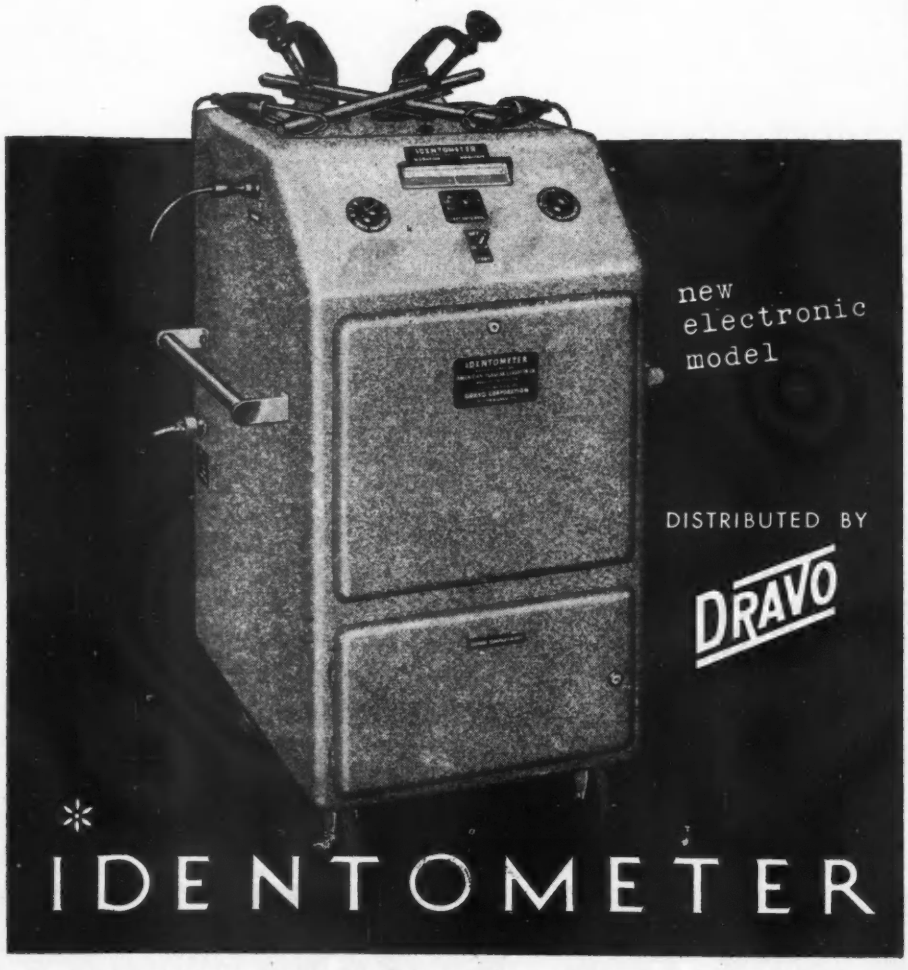
POSITIVE STEEL * IDENTIFICATION

Anywhere

On freight cars, in warehouse stock piles, in the processing department—at any accessible spot where proper current is available the Identometer can be set up for rapid, positive tests to check material against specifications by comparing heats.

Attach a known sample to this handy, portable instrument and the operator can test any number of pieces to check the quality for accurate control.

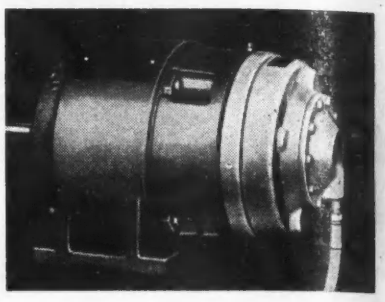
An operator, with only a few hours training, can use Identometer to test most rolled or forged ferrous material and provide a safeguard against error. Read the whole story of this new metallurgical tool!—What it is and how it works is told in Bulletin 4D. Address—Dravo Corporation, National Department, 300 Penn Avenue, Pittsburgh 22, Pa.



AN ELECTRICAL INSTRUMENT FOR THE INSTANT AND ACCURATE IDENTIFICATION OF MOST ROLLED OR FORGED FERROUS ALLOYS BY THE USE OF REFERENCE SPECIMENS

Pneumatic Disk Brakes

The James L. Entwistle Co. of Pawtucket, R. I., has recently announced manufacture of an improved line of pneumatic disk brakes for use on motors or an any other rotating equipment where a quick, smooth stop is required. These brakes include an adjustable torque-control unit which permits adjustment of braking torque from any remote position without change of brake adjustment.



JLE brake and torque control unit

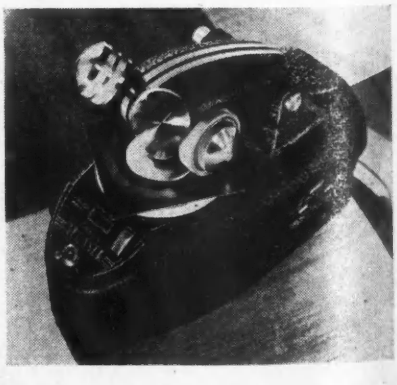
JLE brakes are available with or without the Entwistle control unit in single, double or triple disk with torque ratings of 100, 200 and 300 lb ft.

New Series of Vital Diesel Oils

A new series of Vital Diesel oils, SAE 10 to 50 inclusive, is offered by E. F. Houghton & Co., Philadelphia, Pa. These oils are of the detergent type embodying highly stable solvent-refined stocks, given a special treatment which renders them resistant to oxidation or formation of sludge or corrosion of bearings. They conform to U. S. A. Specifications 2-104B covering heavy-duty lubricants.

Improved Taber Abraser

An improved Taber Abraser, designed and manufactured by Taber Instrument Corporation, North Tonawanda, N. Y., is now available in a complete testing set. The testing set includes a Taber Abraser, with all accessories, together with a specimen table for running tests under wet or moist conditions. An illuminated mag-

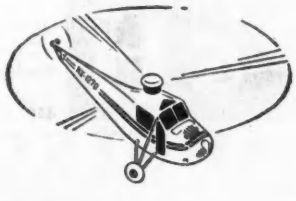


Taber Abraser

(*Turn to page* 106, *please*)

WRITE and tell us any problems you may have on precision parts. Here, in one organization with two great plants, are ALL the facilities the most complex production problem requires . . . from engineering skill through all phases of machining. Long before the war, our performance earned top rating in the industry. We've "come through" under total war output . . . and we intend to stay at the top after Victory! We may have an open capacity on your requirements now. Ask our Executive Sales Office to mail you a booklet covering our *complete* plant facilities.

★ BUY MORE BONDS ★

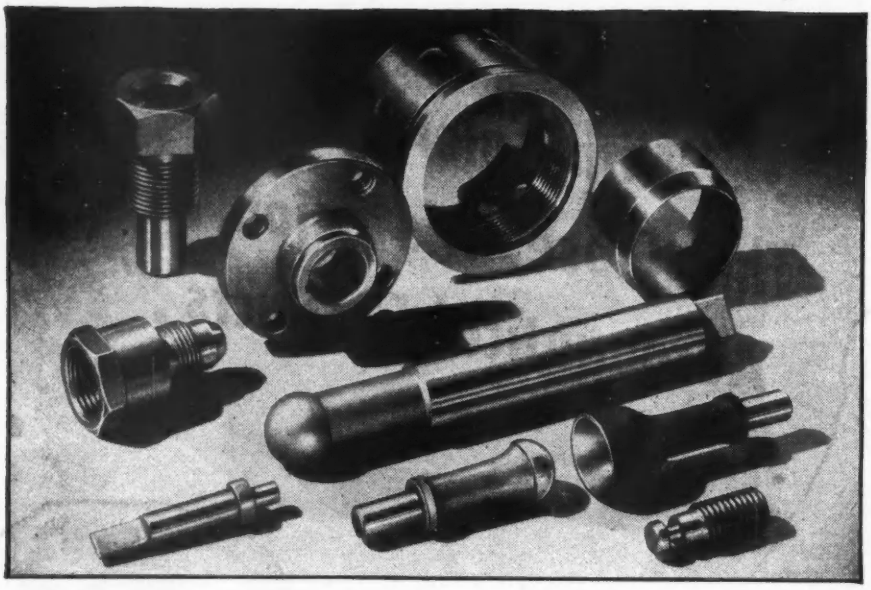


● *THE SUCCESS of the Aeronautical Products, Inc. Helicopter, designed and built by our own craftsmen, promises new accomplishments in the post-war age of flight.*

AERONAUTICAL PRODUCTS, Inc.

DETROIT PLANT
and Administrative Offices:
18100 Ryan Road, Detroit 12

OHIO PLANT:
Washington Court House
Ohio



Never In Headlines

. . . . Often In The News!

It's interesting how some things are taken for granted. For instance, the superlative performance of screw machine products made by The Chicago Screw Company.

These precision parts function faultlessly in aircraft, trucks, tractors, automobiles, diesel and marine engines, radios, and in many other units where hardened and ground parts are utilized. Our parts are never mentioned in headlines, but the units of which they are an integral part are often in the news because of sensational accomplishments . . . When YOU need a dependable source of supply for precision-made, close-tolerance screw machine products, you'll find us an alert, progressive organization adequately prepared to serve you.

ARMY NAVY

THE CHICAGO SCREW CO.

ESTABLISHED 1872

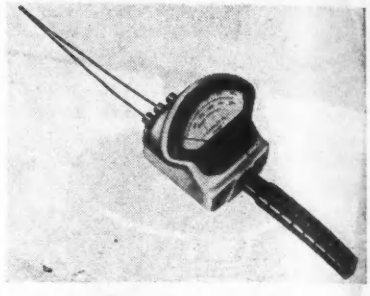
1026 So. Homan Avenue Chicago 24, Ill.

nifier for the inspection and examin tion of specimens is part of the set.

The wearing action of the Abraser performed by dual Calibrase whee bearing against the specimen und constant pressure revolving in opposi directions, one sliding radially towar the outside and the other sliding t ward the inside of the wear path. Eac wheel revolving at a steady constan speed through contact with the spec men exerts a combined abrasive, com pressive and twisting action twice i each revolution of the specimen holde

Lightweight Pyrometer

A portable pyrometer weighing onl 1¾ lb has been brought out by th K. H. Huppert Company, Chicago, Il It is particularly adapted to readin the temperature of molten metals (ex clusive of ferrous metals), hot air o



Huppert pyrometer

liquids and for hot surfaces, if used with the prod type thermocouple.

The body design of the instrument elevates the scale to an angle that of fers maximum reading ease in all working positions and also minimizes side reflections on the scale glass. Dua scale is standard with readings of: 0 to 500 F and 0 to 1000 F, 0 to 750 F and 0 to 1500 F, or, 0 to 1000 F and 0 to 2000 F, or equivalent C.

Write to the Boys Who Are Right at the Front

Engineers Available

Consultation and Service on { MECHANICAL DESIGN • PRODUCT DESIGN • DEVELOPMENT OF PRODUCTS AND PRODUCTION PROCESS MACHINERY AUTOMOTIVE DESIGN • LAYOUT & DETAIL

Phone: Harrison 7747

FRANCIS AND CAPPELLE

1616 Transportation Building, CHICAGO 5, ILLINOIS

P&H

Complete Arc Welding and Materials Handling Service

AC and DC Electric Arc Welders and Electrodes, Welding Positioners, Electric Hoists and Cranes.

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HARNISCHFEGER CORPORATION

ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

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Immediate Warehouse Shipments

COLD FINISHED BARS • AIRCRAFT STRIP STEEL • COLD ROLLED STRIP STEEL
COLD ROLLED SHIM STEEL • SHEET STEEL • ROUND EDGE FLAT WIRE
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STEEL BALLS • FEELER GAUGE • DRILL ROD

GENERAL STEEL WAREHOUSE CO., INC. 1830 N. Kostner Ave. CHICAGO

JOHN CRANE *Bellows* PUMP SEAL

Designed for AIRCRAFT, MARINE, JEEP, TRUCK, TRACTOR AND AUTOMOBILE PUMPS

CRANE PACKING COMPANY 1818 CUYLER AVE. CHICAGO 13, ILL.

Unionization of Foremen

(*Continued from page* 40)

to represent his interests does not have these required qualities.

"If plants are to be operated efficiently and successfully there can be only one leadership. Any outside interference with a part of management by union leaders will importantly destroy the unity of purpose and cooperation which is so essential.

"We believe that union representation of any management group will definitely limit the opportunities of the individuals in that group. Foremen would no longer be able to function as members of management. Hence their authority and responsibility would have to be changed. The consequences would be decreased efficiency, higher costs of production, higher selling prices and reduced employment opportunity.

"One of the promises that will be made by those who seek to unionize our foremen will greater security. This promise appeals to some foremen who are fearful that in the postwar period foremen's jobs may not be available.

"The greatest security is achieved by any individual through knowledge, experience, willingness and ability to do his job. Competent foremen with GM need not fear for their postwar future. There is always a need for competent people. It is true that the reconversion period will necessitate many changes. The necessity for these changes is well understood. The working out of a satisfactory solution requires understanding and patience on the part of all of us. This is being given intensive study by our entire organization. The work record of all members of management has been maintained. No one who has done a good job, prewar and during the war will be overlooked during the postwar period."

Labor Turnover

(*Continued from page* 19)

processes and new techniques. By building moving assembly lines we saved 60 per cent in manhours. One such line for Flying Fortress wings enabled us to utilize unskilled labor, mostly women trained right on the job, and to produce the 500th B-17 wing in the same number of manhours as required for the 1500th identical wing built in another plant in stationary assembly jigs.

Results of these methods brought the nation high dividends in production and saving of time. Against 6,121,000 pounds of airframes and spare parts produced by 17,000 employes of one company in 1940, some 130,000 workers of the same company produced 180,000,000 pounds in 1944. This means that an increase of 665 per cent in personnel paid off with an increase of 2840 per cent in production. This was typical of the entire industry and is the stuff that helps build superior air power.

Peacetime Products IN THE WORLD OF
TOMORROW
HARRIS PRODUCTS
Tomorrow things will be different—peacetime products will again come first and thousands of these new products now marking time will be on the march. Basically our job is to improve your products mechanically and economically through the elimination of vibration.
Our postwar plans primarily embrace the adaptation of Harris products such as:
DUFLEX VIBRATION INSULATORS (Mounts)
TORFLEX BEARINGS
TORFLEX COUPLINGS,
AND COMPRESSED RUBBER BEARINGS
to the myriad of uses in the industrial field as they apply to the elimination of vibration in equipment of all kinds. Wherever there is friction, resistance to motion due to the contact of surfaces, there is vibration, noise and excess wear.
When vibration is eliminated by Harris products, and it is not uncommon to eliminate from forty to ninety per cent of it, noises are silenced, wear and tear are diminished, shock and strain are absorbed, performance and efficiency of equipment are increased, and the life span prolonged many times over.
Although, today, all of our plant facilities are being utilized for military use and essential industries, our engineers will gladly discuss your postwar problems and requirements with you. No obligation.
HARRIS PRODUCTS COMPANY
Specialized Rubber Engineers and Sole Manufacturers of
Duflex VIBRATION INSULATORS (MOUNTS)
Torflex BEARINGS
Torflex COUPLINGS
HARRIS COMPRESSED RUBBER BEARINGS
HARRIS
PRODUCTS COMPANY
CLEVELAND 4, OHIO, U. S. A.

the EQUITABLE POLICY

Since the war began we have devoted ourselves largely to the production of bearings to special dimensions and we expect that because of our wide experience in their construction, these bearings will continue to be a large part of our output. However, we are now devoting an increasing amount of our facilities to the production of *many standard bearings* and we have just published our new 28 page bearing catalog showing in detail the complete line of Equitable Standard bearings. We continue to offer to work with your engineers in the design, application and service of any type of anti-friction bearing on which you may ask specialized advice. Look to Equitable for bearing information for *any* type application, standard or special.

Write for our new catalog No. 44

Equitable BEARING CO. Inc.

DEPT. AI • WALDEN, NEW YORK

New Products for Aircraft

(*Continued from page* 44)

Flasher Operates Blinking Landing Field Lights

The Reynolds Electric Co., Chicago, Ill., is introducing the Reco Thermo flasher No. 4188 which operates through a magnetic relay and lamps to mark the boundaries of emergency airplane landing fields at night.

The new Reco Thermo flasher is supplied in a cylindrical metal container 1½ in. diameter by 1¼ in. long. The complete flasher weighs approximately two ounces. It is made with a standard four prong base for quick replacement in radio type sockets. Under normal conditions the unit will start flashing at 110 volts in from three to five seconds.

Flush Surface Rivet

A new flush surface rivet developed by The Glenn L. Martin Co., Baltimore, Md., is designed with a soft malleable head which flares out in the shape of a truncated cone from the stem with a thickened edge portion extending above its top surface. This edge, when the rivet is driven, is extruded as a flush extension of the head.

Monroe Auto Equipment Company Expands

Monroe Auto Equipment Co. has undertaken a million-dollar expansion program designed to boost production of hydraulic shock absorbers to 25,000 a day, three times the 1940 level. Additional equipment, which will be paid for out of current earnings, has been ordered and will be delivered as soon as tool manufacturers can produce it.

Triple-action hydraulic shock absorbers will comprise the company's principal postwar item. Other products will be a new type hydraulically suspended seat for cars, trucks, and tractors; plated plastics, rubber extrusions, shock absorbers for freight and passenger trains, and hydraulic equipment for aircraft.

For Ignition Switch Service; Directional Switches; Dove Tails
MITCHELL DIVISION
Philadelphia, Pa.

Air Cleaners—Oil Bath and Pre-Cleaners for Engine Protection
UNITED AIR CLEANER DIV
Chicago, Ill.

Divisions of
UNITED SPECIALTIES COMPANY
9705 Cottage Grove Ave. Chicago, Ill.

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• POSITIONS OPEN •
DIESEL ENGINEERS
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FOR DEVELOPMENT WORK
ON
New High Power Engine • POST-WAR POSSIBILITIES • Eastern Location • Address Box 27; care of this Magazine
Statement of availability required.

STAMPINGS
WORCESTER STAMPED METAL © QUALITY STAMPINGS
Heavy, medium and light stampings in any quantity. A steady flow of production—*when* you want it.
WORCESTER STAMPED METAL CO.
9 Hunt Street, Worcester, Mass.
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IT TAKES *MODERN* EQUIPMENT

to produce Tomorrow's

STREAMLINED PRODUCTS

HANSEN *Push-tite* COUPLINGS

Tomorrow's production is going to be the answer as to how you can meet keen competition in the highly competitive market of the coming postwar days. ◆ Competition cannot be met without peak production and peak production cannot be attained without modern equipment, one fits into the other. ◆ One way to reach peak production is by short cuts and that, in turn, means Hansen Industrial Couplings, which are easier to operate, faster, save many steps, much time and a considerable volume of air. ◆ Hansen Couplings are easy to operate, merely insert plug into socket, it is connected, locked and air is automatically turned on. To disconnect, slide sleeve back with thumb, plug is ejected and air is automatically turned off. ◆ *There's a Hansen Coupling made for air, oil, grease, gasoline, oxygen and acetylene. Send in for free industrial catalog.*

THE HANSEN MFG. COMPANY

1786 EAST 27th STREET • CLEVELAND 14, OHIO

USE SPECIALIZED OAKITE MATERIALS

for SAFELY

CLEANING ZINC BEFORE CHROMATING

Unless the surfaces of the zinc alloy die castings, zinc plated parts, galvanized or other products on which you are using the Cronak process or similar chromating techniques are first made chemically clean, it is impossible to obtain a satisfactory, uniform and lasting finish of the desired corrosion-resistance.

Grease, shop dirt and similar foreign matter must FIRST be removed . . . and here is where specialized Oakite materials and procedures will prove unusually effective. Not only do they RAPIDLY, completely rid zinc surfaces of these accumulations, but they do the job SAFELY . . . leave zinc coatings unharmed. A trial will convince you that they are QUICK-ACTING, easy-to-use...economical, too.

Send for *FREE* Data!

For FREE data PLUS helpful Oakite Technical Service on this and all your other production cleaning, write today . . .

OAKITE PRODUCTS, INC.
30H Thames St., New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE Buy Bonds for Victory
Specialized cleaning
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Plastic Materials in Aircraft

(*Continued from page* 38)

modulus of elasticity made them of questionable value, structurally. A change in approach to the problem was obviously necessary. Up to this time the resinous material had dominated the picture, the filler being considered only as an additive which merely modified the material. The new trend is to put emphasis on the filler, the non-resinous component, treating the plastic as a binder.

Early work had been done with natural and synthetic fibers with favorable results; however, the introduction of glass cloth marked the turning point, or perhaps it should be designated as the true beginning of plastic structural materials. Studies of Fiberglas cloths laminated with various resins brought out several factors, first that the properties of the material are different from those of metal, wood, or other materials commonly used in aircraft construction. In that the glass is in the form of very fine fibers, the failure of one fiber due to local redistribution is negligible. These phenomena to an extent can be compared to the elongation of metallic materials. It is reasonable to believe that this type construction is inherently insensitive to the effect of notches, thus the almost negligible effect of discontinuities caused by small, irregularly-shaped holes on a web of this material is explained. Secondly, it was noticed that although tensile strength of approximately 50,000 psi was attained, the Young Modulus though higher than other plastic materials or laminates was lower than aluminum, magnesium or steel, materials commonly used in aircraft structure. The glass laminates showed a modulus of approximately three million psi as compared with ten million for aluminum, six million for magnesium and thirty million for steel. The third factor of importance is the comparatively high sound and vibration dampening qualities, a valuable asset to the aircraft manufacturer. With these factors in mind one can easily see the conventional concept of design will have to be modified if the full value is to be derived from this lightweight, high-strength but moderately stiff material.

Two types of construction using glass laminates are prevalent in present design—all-glass laminates and glass-wood or glass-foam sandwich construction. The outstanding example of the former type construction, the all-glass laminate, is the R-6 army helicopter cabin redesigned for plastic use and built by the Swedlow Aeroplastics Corp. and now in production at the U. S. Rubber Co. The entire cabin, forward of the firewall, is made of low-pressure Fiberglas laminate using fewer parts and less production time than required for the original all-aluminum structure.

The latter type construction was used

(*Turn to page* 114, *please*)

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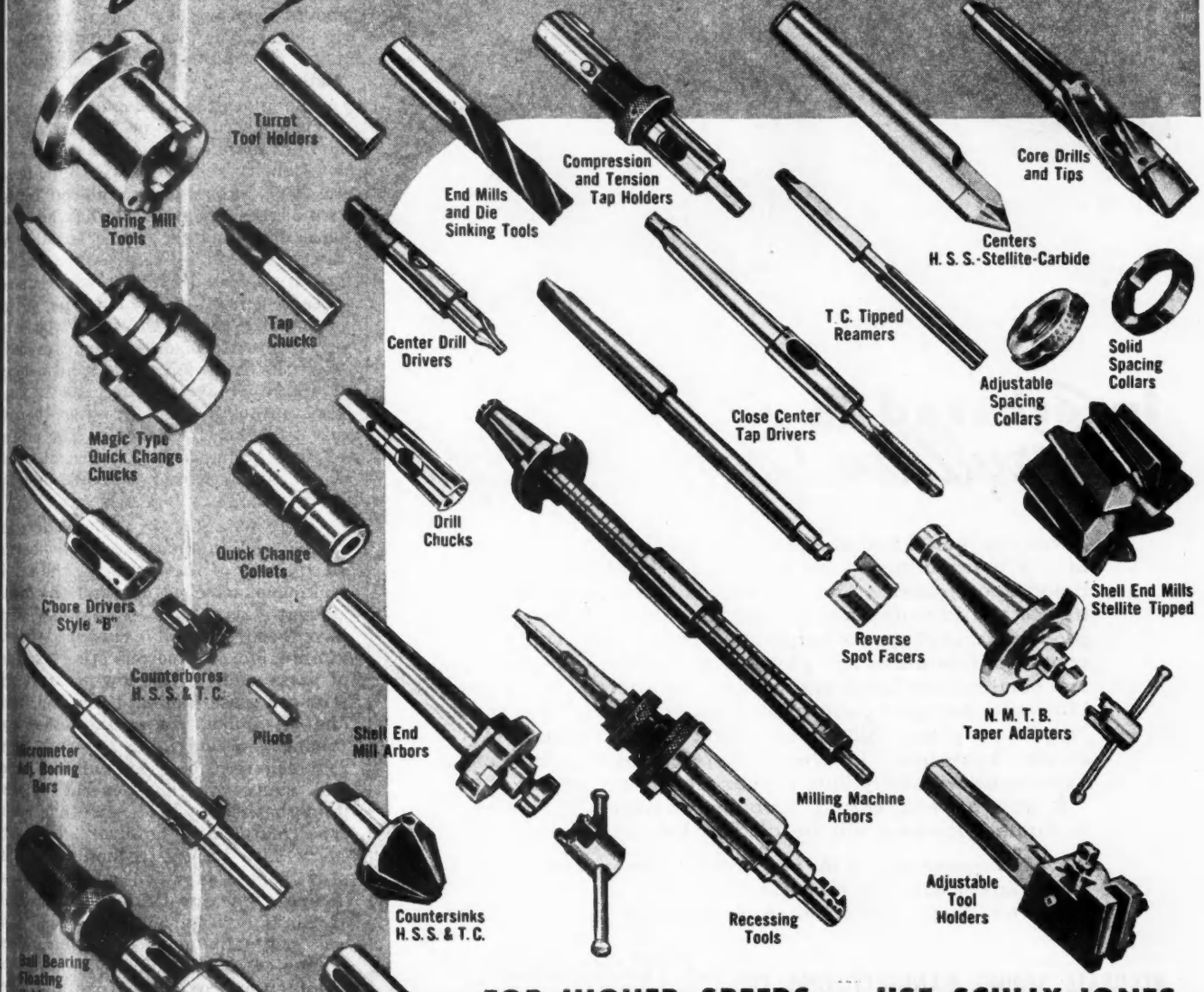

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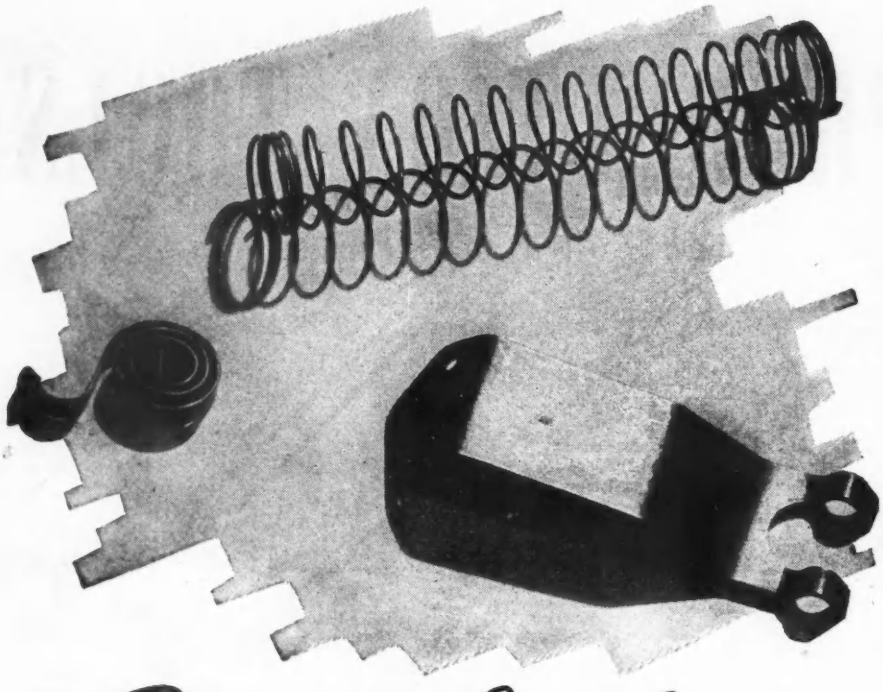

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by the Army in an experimental se monocoque fuselage of a BT-15 Conso dated Vultee trainer.

The all-glass laminate type of c struction consists of building up pl of resin impregnated cloth, applying small amount of pressure to assure smooth surface and intimate contact b tween the plies, and placing the a sembly in an oven for curing. Wh the resin is cured, the assembly is r moved from the oven, the parts trimm if necessary and assembled by cemen ing, riveting or other conventio methods.

The glass-foam or glass-wood sa wich construction is fabricated in similar manner except that a suitab low-density sheet of a synthetic-form resin or light wood is placed betwe two layers of glass cloth which ha been impregnated with a suitable lo pressure resin. The pressure and he are applied and the sandwich is cure Attachment of sandwich-type sectio is usually made through wooden other suitable inserts which are inclu ed in the sandwich. The sandwich-ty laminates may function as a shea resistant skin by improving the stif ness and thereby removing the proble of oil-canning, an ever present troub where skin-stressed aircraft design used.

Other advantages of these aforeme tioned laminates are the natur smoothness of the surfaces, the ease making exact contours and the overa strength retention of surfaces whi have been partially ruptured due gunfire, etc. Numerous other exampl of parts made of this low-pressure hig strength glass laminate are fuel, wat and oil tanks, wheel and other typ fairings, access and life-raft door pyrotechnic tubes, ammunition box and many others. Several of thes items have been made of other plast type materials; however, in near every case weight reduction and im provement was noted when the glas laminate was substituted. An examp of this is a 20-in. antennae mast whic was originally made of a phenolic-im pregnated cotton duck laminate an weighted approximately one and thre quarter pounds. The new Fibergla laminate mast of the same lengt

(*Turn to page* 116, *please*)

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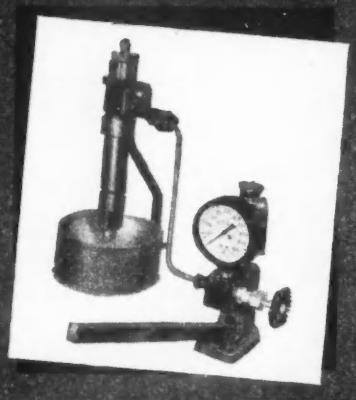

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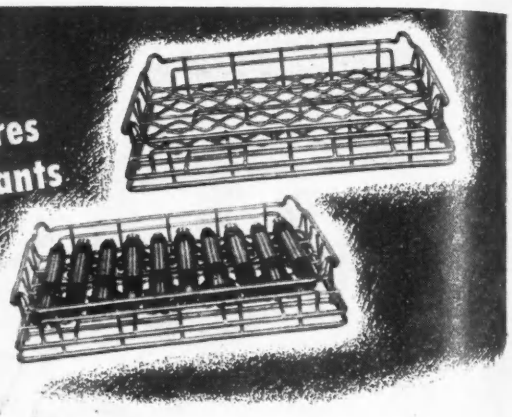

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Non-Structural Applications—Excellent electrical insulation, ease of forming, molding, extruding, and machining, eye appealing permanent colors, abrasion resistance, low specific gravity, and low cost, make plastics a natural choice for this class of aircraft parts. For some years electrical and radio parts manufacturers had been using plastics in industrial applications and were well aware of their advantages when asked to design aircraft equipment. For this reason, vinyl conduit, polystyrene and phenolic terminal strips, phenolic impregnated fabric antennae housings, and radio antennae masts as well as molded phenolic radio and electrical plugs, switches, sockets, etc., have long been used.

As a result of work done with the acrylics, methyl methacrylate, a superior transparent sheet with improved light transmission characteristics, capable of being formed on simple wood forms, was developed. This material is half as heavy as plate glass and today is the standard transparent material used in aircraft enclosures.

Phenolic impregnated fabric laminates have been used as control cable pulleys since 1921 and cable guards, brackets, bushings, spacers, filler blocks, chafing strips, bumper plates, trim tabs, ammunition boxes and tracks, data cases, and fairleads made of this ma-

(*Turn to page* 118, *please*)

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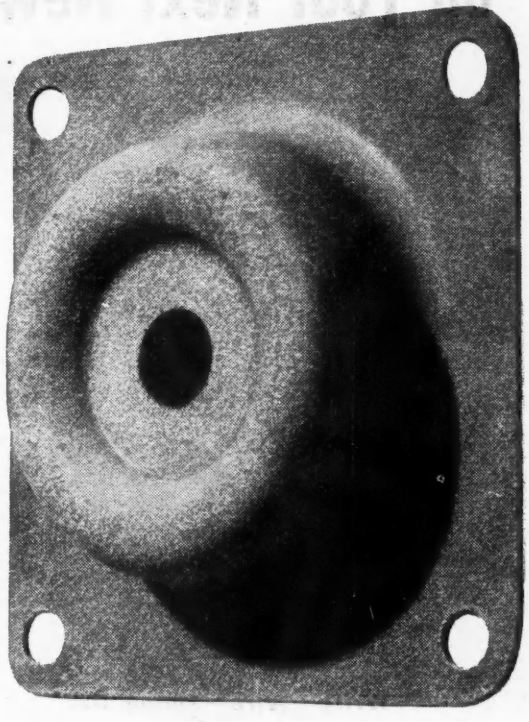

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terial have likewise enjoyed several years of use in modern aircraft. Partial explanation for the continued success of this material is the more recent development of the "thermo-elastic" or post forming technique which allows forming of cured sheet thus adding to its versatility.

Extruded Vinyl already mentioned as being used in electrical and radio application is also found in relief tubes and enclosure seals. This same type material calendered into sheet is used as scuff plates, bumper pads, and as a substitute for leather. A very thin sheet of vinyl has satisfactorily replaced a fabric several times its weight as an impervious septum in a sound-proofing batt of Fiberglas used on one type of bomber. More recently a bladder type water bag, not too much unlike the Biblical goat-skin in appearance, has been fabricated from Vinyl for use as a personnel water supply. Weighing less than one-half as much as the conventional metal container, it is unaffected by the pressure of freezing water, for it merely stretches to accommodate the bulging mass.

Interest in the comparatively new foam materials now available has definitely grown. These materials consist of a series of expanded unicellular foam-type materials which may or may not contain a filler. Materials which are expanded in this manner are cellulose acetate, polystyrene, and several other organic materials. Low density is the keynote of these materials with some other interesting qualities such as the fair compressive strength found in the glass filled cellulose acetate and the controlled absorptive qualities of other of the organic materials.

A tendency on the part of designers to discount the importance of non-structural parts, accepting them as something that deserves a minimum of design time and design experience, has resulted in many cases in the lowering of the overall quality of the airplane. As indicated, the largest percentage of plastic material used in aircraft go into parts in this category and should therefore receive careful consideration. There is no substitute for a thorough knowledge of the material and a little common sense, whether designing with plastics or other materials.

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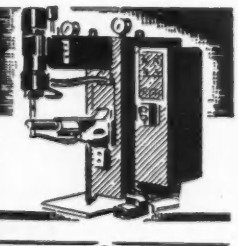

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